DEIS-APPENDIX 10

FUEL SPILL RISK ANALYSIS

NAVIGATION IMPROVEMENTS,

DELONG MOUNTAIN TERMNAL, ALASKA

Fuel Spill Risk Analysis
Navigation Improvements, DeLong Mountain Terminal, Alaska

1.0 Risk Analysis Methodology.

This analysis summarizes the evaluation of the potential for each of the alternatives considered in detail in the Draft Environmental Impact Statement (DEIS) to influence the likelihood, magnitude, and potential impacts associated with large fuel spills near Portsite. It also presents general information related to the project's potential to influence large spills associated with vessel accidents and transportation-related fuel spills outside northwestern Alaska. The low frequency of significant spills from non-tanker vessels, the high variability of the volumes spilled, and the factors that contribute to individual incidents do not allow the use of existing information to quantitatively estimate the influence a future action may have on spills from non-tanker vessels. Instead, this analysis makes general comparisons of the existing conditions and the anticipated changes to several factors that would most likely affect the frequency or magnitude of spills from non-tanker vessels and attempts to predict the logical consequences of those changes.

As a basis for evaluation, this analysis compares the risks of fuel spills associated with the Third Barge, Breakwater-Fuel Transfer, and Trestle-Channel alternatives with the risks associated with existing facilities and operations. It concentrates on facilities and operations that would be changed by one or more of the alternatives. It does not address operations at the mine, transportation of fuel to the mine, or any winter storage, transfer, or transportation issues that would not change as a result of navigation improvements at DMT. Additionally, due to the nature and location of the fuel-related facilities at Portsite, the minimal changes proposed for land-based fuel system components and operations, the relative risks to important resources, and the reliance the anticipated changes in regional fuel distribution would have on marine transportation, this analysis emphasizes the project's potential to influence large spills to water. In general, processes that do not have the potential to spill large volumes are not addressed because they are more difficult to predict and the associated impacts are less significant.

Predicting oil spills and their potential impacts to the environment is an exercise in probability. Significant uncertainty exists regarding the number of spills, their size, location, type of fuel that may be spilled, and the potential receptors and environmental conditions that may be present at the time a spill might occur. To attempt to define the likelihood and magnitude of a spill, knowledge about the facilities, activities, and working environment is used in conjunction with historical spill data associated with existing and similar facilities, similar activities and/or environments, and accepted methods for calculating maximum and probable spill volumes. To analyze the potential effects of a hypothetical spill, reasonably anticipated spill magnitudes are applied to site specific information to estimate the area that would be impacted, the nature and effectiveness of spill response capabilities, and the nature and magnitude of the effects on existing resources.

2.0 Background/Existing Conditions.

This analysis provides summary information about the existing facilities and Alternatives considered in detail. However, it relies on more detailed information provided in the draft EIS. The existing Portsite facilities were built in the late 1980s on

450 acres leased by the Alaska Industrial Development and Export Authority (AIDEA) from the Northwest Alaska Native Association (NANA) Regional Corporation for 99 years. The AIDEA owns all improvements at Portsite. An additional 64 acres of tideland are leased from the State of Alaska for the existing DMT facilities at Portsite. Fuel transfer and storage facilities at Portsite have been operating since 1988. Approximately 20 million gallons of fuel (diesel and Jet A) are transferred through the system each year to meet the operational needs of the mining and shipping operations. Fuel is supplied by a variety of independent sources using tugs and tanker barges. Manifolds on the south side of the first and second sheet-pile cells transfer fuel from barges through a 12-inch-diameter pipeline directly to onshore storage tanks (figure 1). All major fuel tanks and pipelines at Portsite are aboveground. They are inspected weekly and checked for leaks hourly during fuel transfer operations.

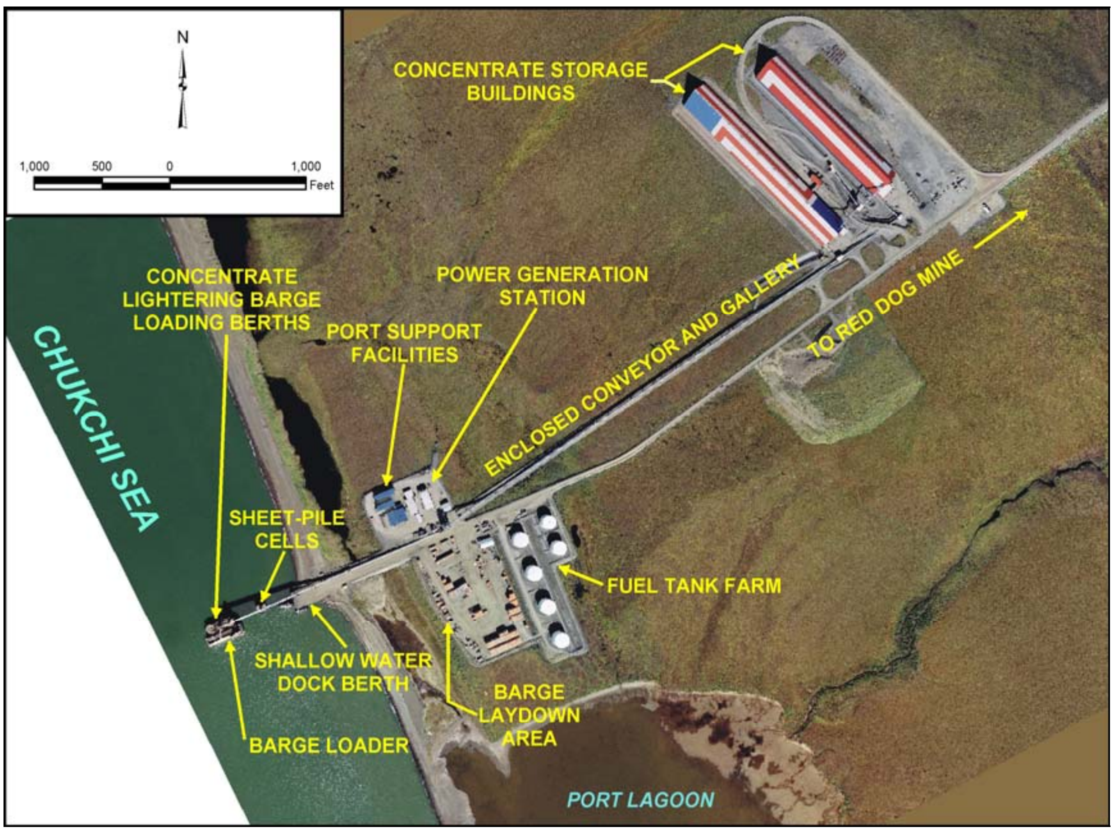

Figure 10-1. Principal Facilities at Portsite.

Although there have been several significant spills at Portsite, along the DMTS Road and at the mine over its 16 years of operation, the largest single spill of petroleum products into marine waters was about 40 gallons of hydraulic fluid from a ship loader on the DMT loading platform. During the project life to date, with more than 200 million gallons of fuel offloaded to Portsite, the largest single spill of diesel (or similar jet fuel) into marine waters was 0.13 gallons. This record is due in part to the relative simplicity of the existing fuel system components and to exceptional inspection standards, operational procedures, and operator training.

3.0 Description of Alternatives.

Complete descriptions of the alternatives are provided in the draft interim feasibility report. Descriptions of the components most relevant to fuel spill risk analysis are provided below. Although the actual impacts to fuel distribution patterns are difficult to forecast, it is anticipated that both the trestle-channel and breakwater-fuel transfer alternatives would increase the annual volume of fuel transferred through the facility from about 20 million gallons to about 50 million gallons. The third barge alternative would not impact existing fuel transfer volumes or distribution patterns.

3.1 Third Barge Alternative.

The third barge alternative is a “non-structural” alternative. It would require no major modification of the existing port facilities. A third lightering barge with one or two more assisting tugs would be added to the existing operation. For ease of operation and maintenance, the new barge would be designed substantially the same as the two existing self-unloading lightering barges. The existing operations and total number of trips required to load the annual ore concentrate production would not change. However, total vessel traffic, the total number of fuel transfers required to operate the tugs, and the associated risk of spills from transfers and vessel accidents would increase.

3.2 Breakwater-Fuel Transfer Alternative.

The Breakwater-Fuel Transfer Alternative would construct a breakwater to provide a protected maneuvering area for tugs and barges and a fuel transfer system to receive fuel from large ocean-going tankers. The breakwater would be a 2,800-foot-long straight rubblemound breakwater parallel to shore about 695 feet seaward of the third sheet-pile cell of the existing loading facility. The fuel transfer portion of the alternative would consist of a new onshore pumping station and an underground/undersea pipeline running from the pumping station to a mooring area about 10,000 feet offshore in water at least -43 feet mean lower low water (MLLW). The 20-inch-diameter, ¼-inch-thick steel pipeline would be installed in a horizontal, directionally drilled tunnel for the first 2,500 feet to minimize beach disturbance and effects on the lagoon just shoreward of the beach. It would be buried in a cut-and-cover trench for the remaining distance to the offshore terminal. Tanker ships bringing fuel to Portsite would tie off to mooring buoys, raise a flexible pipe from the bottom, and connect it to the ship’s fuel discharge manifold. The fuel would then be pumped to the fuel storage tanks. When the tanker was unloaded, the ship would return the flexible pipe to the ocean floor. Figure 2 illustrates the primary fuel-related components of the Breakwater-Fuel Transfer Alternative.

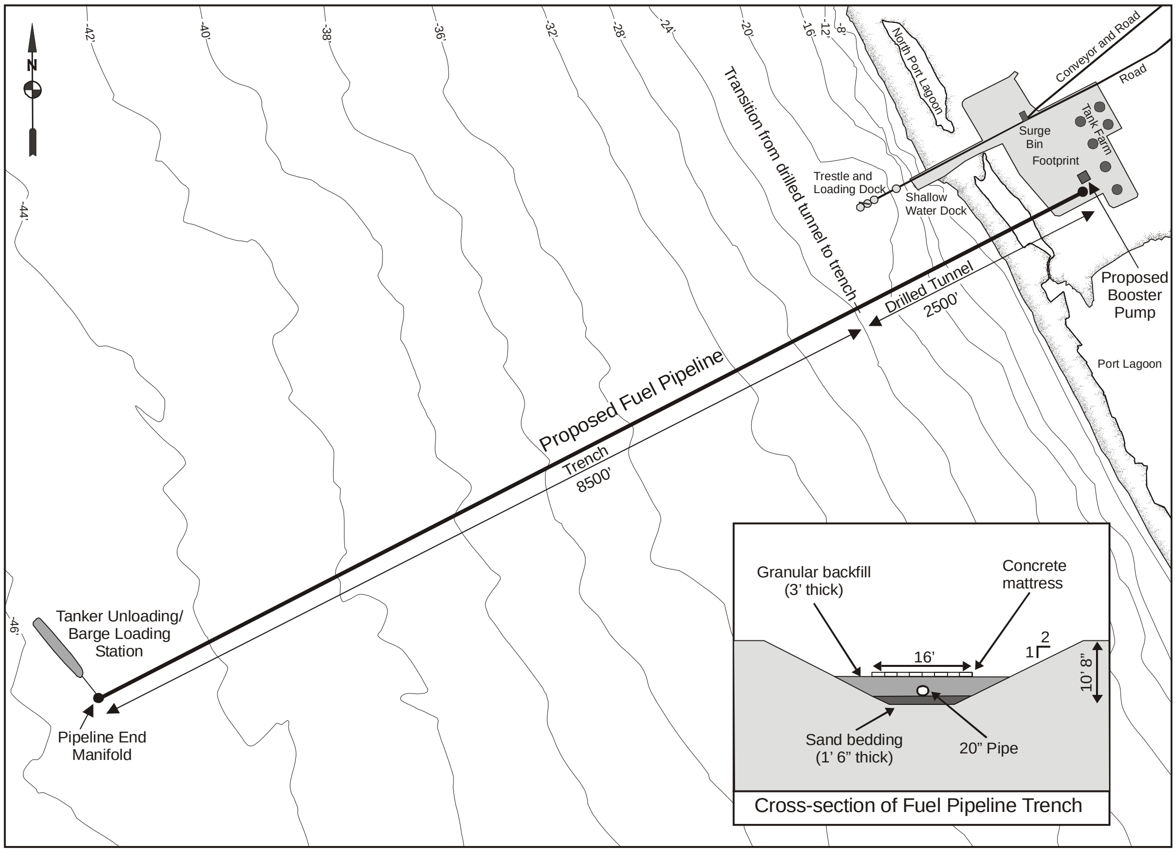

Figure 2. Pipeline and Trench for the Fuel Transfer Alternative at Portsite.

3.3 Trestle-Channel Alternative.

The Trestle-Channel Alternative would construct a new 1,450-foot-long trestle from existing shore-based facilities to a new loading platform, a 3.5-mile channel from the loading platform to the -53 feet MLLW depth contour, and a berthing area and turning basin adjacent to the loading platform to allow maneuvering of large ocean-going bulk freighters and tankers. The loading platform would feature ore concentrate loaders to load bulk freighters and a fuel distribution manifold for receiving fuel from tanker ships. A 12-inch pipeline would connect the new manifold to existing storage facilities. A new storage tank would be constructed adjacent to the existing fuel tanks to store gasoline. The major components are illustrated in figure 3.

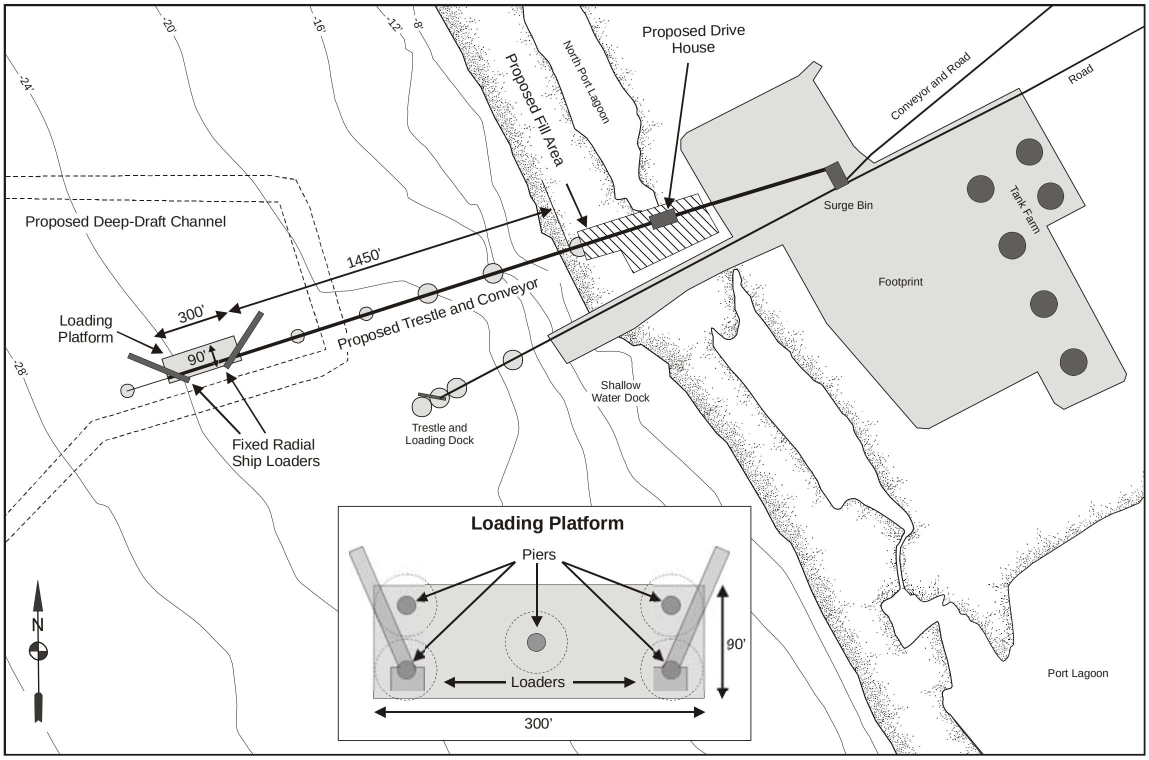

Figure 3. Major Components of Trestle-Channel Alternative

4.0 Information Used for Analysis.

Sources of data and information relevant to fuel spill risk analysis often include numbers and volumes of spills of crude oil, various refined petroleum products, and other hazardous materials to land and water from facilities that are operated under a wide range of environmental and operational conditions, time frames, and regulatory scrutiny. Because of the sporadic nature of fuel spills, one significant spill, or the lack of any spills within a specific time interval could disproportionately influence the results of an analysis that is narrowly focused. Conversely, if data from a broader range of sources is used, the influence of significant site and facility-specific factors could be inappropriately minimized. For this reason, a combination of wide-area and site-specific data is used for analysis. Long-term trends and changes in regulations, equipment, and facility operations are also considered.

This analysis uses fuel consumption estimates from the Energy Information Administration (EIA) and spill data from the U.S. Coast Guard (USCG) and Alaska Department of Environmental Conservation (ADEC) to attempt to forecast the general likelihood of fuel spills at Portsite based on data generated in the State of Alaska between 1995 and 2001. This data is compared with site-specific data associated with spills reported in the Northwest Arctic Borough and at Portsite and to general information related to fuel spills in Northwest Alaska, Alaska, and the United States.

The period from 1995 through 2001 was selected because of the completeness of the fuel usage and spill data for that period. State spill data prior to 1995 appears to be less complete and reliable. USCG and EIA data for fuel spills to water and fuel consumption, respectively, subsequent to 2001 were not available at the time this analysis was prepared. It is also notable that the ADEC spill report data is tracked and reported by fiscal year rather than calendar year. The actual reporting period for the State spill report data is from July 1, 1995, through June 30, 2002. The USCG and EIA data is reported by calendar year. The 6-month shift in reporting dates is not considered significant in the overall evaluation of data generated over a 7-year period.

5.0 Spill Likelihood/Magnitude.

Several objective factors including the volume of fuel handled, type of facility and nature of its operations, and its location and related environmental conditions can influence the likelihood of a potential spill to occur at a particular facility. Information and analysis of data associated with each of those factors is presented below.

5.1 Facility Throughput.

The most generalized approach to estimating potential fuel spills is to group all spills and all uses and determine the average spill rate for an area. Table 1 summarizes the fuel volumes used and spilled in Alaska from 1995 to 2001.

Table 1
Summary of Fuel Used and Fuel Spilled in Alaska (1995-2001)
(All volumes are reported in U.S. gallons)

	Non-Crude Oil Consumption	Total Non-Crude Oil Spilled	Non-Crude Oil Spilled to Water
1995	1,750,000,000	160,367	61,463
1996	1,797,010,000	161,243	14,187
1997	1,900,960,000	276,831	22,512
1998	1,917,260,000	118,309	15,734
1999	2,039,180,000	347,095	56,733
2000	2,037,000,000	123,555	15,493
2001	2,146,160,000	273,187	47,435
Annual Average	**1,898,224,000**	**208,655**	**33,365**
Cumulative Spill Rate*		**0.000110**	**0.000018**

*: Spill rate is calculated by dividing the volume spilled by the volume consumed.

The calculated spill rates indicate that approximately 1.1 gallons of refined petroleum were reported spilled in Alaska for each 10,000 gallons of fuel consumed in Alaska between 1995 and 2001. About 16 percent of the oil spilled was spilled to water. These rates represent a composite of all refined petroleum products and all refining, transportation, and storage activities. They do not account for any site-specific factors that could contribute to increases or decreases in the likelihood or severity of fuel spills at a particular site or activity. Hence, their use is limited without applying additional data to compensate for local environmental and facility conditions, equipment, and operational variables.

During the same period (1995 through 2001) approximately 710 gallons of petroleum were reported spilled at Portsite facilities (TCAK 2004). About 46 gallons of the total (mostly hydraulic oil) was spilled into the Chukchi Sea. Based on an estimated annual throughput of about 20 million gallons, the rates for total petroleum spills and petroleum spills to water at Portsite between 1995 and 2001 were 0.0000051 and 0.00000024, respectively. These rates are not directly comparable to the statewide rates because they only represent part of the total transportation, handling, and storage activities associated with the petroleum used at the DMT and Red Dog Mine. The total spill rate at Portsite was about 1/20th the statewide rate and the rate for spills to water was about 1/75th the statewide rate for the same period. Although the rates are not directly comparable, Portsite activities probably represent more than 1/20th of the total handling activities associated with the petroleum transferred through them and therefore indicate that Portsite petroleum handling operations during that period, in general, spilled a smaller proportion of products than average petroleum handing operations in Alaska. It is noteworthy that the spills reported to water at Portsite were primarily associated with hydraulic oil. No significant spills of fuel products to water have been reported at Portsite since it began operation in the late 1980s.

5.2 Facility Type

Regulated/Unregulated Facilities. The fuel facilities at Portsite and most other major fuel-handling facilities in the state are regulated by the ADEC. Table 2 compares the relative numbers and volumes of spills of hazardous materials (excluding process water from crude oil production facilities) from regulated and unregulated facilities reported to the State of Alaska between 1995 and 2001.

Table 2
Spills of hazardous materials at Regulated and Unregulated Facilities in Alaska (1995-2001)
(Excludes process water from crude oil production facilities.)
(Volumes are reported in U.S. gallons)

	Regulated Facilities		**Unregulated Facilities**	
	Number	**%**	**Volume**	**%**
Spills	2,466	16%	11,786	84%
Volume Spilled	778,512	26%	2,164,798	74%
Average Spill Volume	219		160	

It is notable that about 5 times as many spills occurred and about 3 times the volume was spilled at unregulated facilities. The most common unregulated source of spills was vehicles. Vehicles averaged 567 spills per year and 86 gallons per incident. Accidents were the leading cause of spills from vehicles. The average volume of spills from regulated facilities was about 37 percent larger than spills from unregulated facilities.

Facility Components. The existing facilities and/or potential project alternatives at Portsite include barge tanker, ship tanker, pipeline, and storage system components. Table 3, presents the relative contribution of each major component to the total spill volumes from regulated facilities in Alaska between 1995 and 2001.

Table 3
Relative Contributions to Total Petroleum Spills From all Regulated Facilities in Alaska (1995-2001)
(Volumes are reported in US gallons.)

	Number of Spills		**Volume Spilled**		**Average Spill Volume**
	Number	**%**	**Volume**	**%**	
Tanker Ships	56	2%	1,056	0%	19
Tanker Barges	86	3%	14,081	2%	164
Terminal Storage/Transfer	189	8%	44,718	6%	237
Regulated Pipelines*	369	15%	465,081	57%	1260
Refinery Operation	377	15%	50,821	6%	135
Other (Primarily Oil Exploration)	1,390	57%	231,755	29%	167

* 61% of the total volume spilled from pipelines is associated with a single act of vandalism. Ignoring that anomalous incident would reduce the volume spilled from pipelines to 181,380 gallons.

Based on statewide historical spill data, the pipelines present the greatest risk for significant fuel spills. However, it should be noted that more than 61 percent of the volume spilled from pipelines during the reference period was spilled during a single event where a bullet penetrated a crude oil pipeline when a person intentionally shot it with a rifle. Such events are rare and, in this case, significantly misrepresent the risks associated with pipelines. Overall, pipelines are a safe and efficient way to transport fuel.

At Portsite, the existing pipeline from the receiving manifold to the tank farm is about 3,500 feet long. It is visible along its entire length and is inspected at least weekly; during fuel transfer operations it is inspected hourly. The length and operation of the existing pipeline is more comparable to standard transfer components at terminal storage/transfer facilities than standard pipelines, which are typically measured in miles and are not normally as accessible or as rigorously inspected. The pipeline components associated with the trestle-channel alternative would be essentially the same as the existing system but would be about 1,000 feet longer. However, the pipeline components associated with the Breakwater-Fuel Transfer Alternative would be about 7,500 feet longer, less visible, less accessible, and small leaks may not be as detectable as they are with the existing system.

Although statewide spills from pipelines accounted for 15 percent of the spills and 57 percent of the volume spilled, no significant spills from pipelines at Portsite have been reported. It is also notable that the combined volume of spills from tanker vessels (ships and barges) is about 2 percent of the total volume spilled. Average spill volumes from tanker ships and barges were 19 gallons and 164 gallons, respectively.

5.3 Operational and Environmental Factors.

The relative impacts of operational and environmental factors on the frequency and magnitude of spills can be generally characterized by relating the historical causes of spills with the associated number, and volumes of spills at similar facilities operating under comparable of conditions. Table 4 presents the numbers, general causes, and frequencies of spills from regulated facilities (excluding process water) in Alaska, the Northwest Arctic Borough (NWAB), and the DeLong Mountain Terminal (DMT) between 1995 and 2001. Table 5 presents the relative, cumulative and average volumes associated with the spills. It should be noted that the DMT stores and transfers more fuel than any other facility in the NAB. Currently, facilities in Nome and Kotzebue each process about half of the annual volume of fuel that is processed through Portsite.

Table 4
Causes and Numbers of Spills from Regulated Facilities (1995–2001)
(Excluding process water from crude oil production)

	State of Alaska		NAB		DMT	
	Number	**%**	**Number**	**%**	**Number**	**%**
Component Failure	8,107	51%	634	67%	7	50%
Human Factors	4,024	26%	179	19%	4	29%
Accident	573	4%	18	2%	1	7%
Other/Unknown	3,027	19%	112	12%	2	14%
Total Spills	15,731		943		14	

Table 5
Causes and Spill Volumes from Regulated Facilities (1995–2001)
(Excluding process water from crude oil production)
(Volumes are reported in U.S .gallons.)

	State of Alaska		NAB		DMT	
	Volume	**%**	**Volume**	**%**	**Volume**	**%**
Component Failure	977,246	33%	234,637	28%	528	75%
Human Factors	659,812	22%	18,583	2%	120	17%
Accident	464,699	16%	152,976	18%	5	1%
Other/Unknown	841,553	29%	426,106	52%	51	7%
Total Volume Spilled	2,943,310		832,302		710	
Average Spill Volume	187		883		51	

Analysis of the causes of spills indicates a general consistency between the causes of local, regional, and statewide spills. Structural and mechanical component failures and human factors combined to represent 77 percent of the statewide spills, 86 percent of the NAB spills, and 79 percent of the Portsite spills. However, the associated spill volumes are inconsistent. At Portsite, the two factors (component failures and human factors) combine to represent 92 percent of the volume spilled. Conversely, the combined volumes statewide and in the NAB represented 55 percent and 30 percent, respectively of the total spill volumes. The average spill at Portsite was about ¼ the volume of the overall statewide average, about 1/5 of the statewide average at terminal storage and transfer facilities, and about 1/17 of the average spill in the NAB. Spills in the NAB represented only about 6 percent of the total number of spills statewide but about 28 percent of the total volume spilled. Although the lower average spill volumes at Portsite may be indicative of superior operational controls or work practices, it is probably partially attributable to the fact that the referenced data set does not include any large spills at Portsite. Post-2001 spill data from Portsite includes a 4,880-gallon on-land spill in 2004. One similar event within the referenced reporting period would have increased the average spill volume to a level comparable to the statewide average, although not to a level comparable to the NAB average.

Based on the contribution of component failures to the overall spill frequency and magnitude, inspection and access for leak detection and maintenance should be considered strong factors in determining overall fuel risk for spills.

6.0 Response Planning Volumes

Teck Cominco Alaska, Inc (TCAK) has developed and implemented an Oil Discharge Prevention and Contingency Plan (ODPCP) for the operation of Portsite facilities (TCAK 2004) to meet the combined fuel spill prevention and response planning requirements of the ADEC, USCG, and U.S. Environmental Protection Agency (EPA). Through the development of the ODPCP, TCAK has developed policies and procedures to prevent spills from occurring and plans to respond to spills should they occur. Spill scenarios and appropriate responses to reasonably foreseeable spills have been developed to address response-planning standards. Programs to stage and maintain appropriate equipment, materials, to train qualified personnel, and to establish means of accessing additional resources to effectively manage a large or unforeseen event have been implemented.

Worst-case planning volumes have been developed for ADEC (based on the volume of the largest tank with adjustments made for spill containment, and application of testing and training programs), EPA (based on the volume of the largest tank), and USGC (based on pipeline volume, discharge rates, and likely shutdown times). These planning volumes are used to define the magnitudes of the spill scenarios that determine response-planning requirements.

The existing worst-case response planning volumes for ADEC, EPA and USCG requirements are about 845,000, 185,000, and 40,000 gallons, respectively. For spills to water, Maximum Most Probable Discharge (MMPD) and Average Most Probable Discharge (AMPD) are defined as 10 percent and 1 percent of the USCG's worst-case planning volume, respectively. Due to the nature and characteristics of the facilities at Portsite and the ability to effectively respond to on-land spills, the effects of a large fuel spill on land would not likely significantly impact resources more than a few hundred feet outside developed areas. Conversely, a large spill to the Chukchi Sea would have the potential to impact large undeveloped areas over a broad range of habitat. For that reason, this analysis focuses on spills to water.

The USCG's Worst-Case Discharge (WCD) is calculated by adding the volume of the pipeline from the marine manifold to the first valve located inside a lined surface impoundment and the volume that would be lost based on the time to detect a spill and the time to cease fuel off-loading. The USCG's WCD for the existing Portsite facilities is 40,000 gallons and is based on 3,431.5 feet of 12-inch pipeline, a transfer rate of 5,600 gallons per minute and conservative estimates of 3 minutes to detect a spill and 30 seconds to shut down transfer operations once a spill is detected.

Based on approximately 4,500 feet of 12-inch pipeline associated with the Trestle-Channel Alternative, and approximately 11,000 feet of 20-inch pipeline associated with the Breakwater-Fuel Transfer Alternative, a transfer rate of 5,600 gallons per minute, and conservative estimates of 3 minutes to detect a spill, and 30 seconds to stop flow, the WCDs for the Trestle-Channel and Breakwater-Fuel Transfer alternatives would be approximately 46,000 gallons and 199,000 gallons, respectively. Therefore, the MMPD and AMPD associated with the Trestle-Channel Alternative would be 4,600 gallons and 460 gallons, respectively, and the MMPD and AMPD associated with the Breakwater-Fuel Transfer Alternative would be 19,900 gallons and 1,990 gallons, respectively.

7.0 Predicting Spill Rates at Portsite.

Based on analysis of historical spill data, the frequency and magnitude of spills at Portsite are lower than the statewide average and well below the average of similar facilities in the NAB. This is particularly true for spills to water. Additionally, the causes of spills at Portsite appear to be generally consistent with the causes of spills statewide and in the NAB. Therefore, it is reasonable to apply statewide averages for similar facilities to attempt to predict the frequency and magnitude of fuel spills that may occur at Portsite in the future. Because all the bulk fuel currently processed at Portsite is diesel or Jet A (similar to diesel), and future bulk fuel operations would also primarily process the same fuels, diesel fuel is assumed for all spill scenarios.

At Portsite, the risk of large spills to water from storage and transfer facilities is primarily associated with fuel transfers between marine-based tank vessels and the land-based storage facilities. The risk associated with the existing facilities and both construction alternatives is manifested in the use of a pipeline to transfer the fuel over water between connections at the vessels and on-shore storage facilities. To calculate an overall spill rate of spills to water from storage and transfer operations the following assumptions have been made.

- Statewide average spill rates for regulated terminal/storage facilities would apply to the existing facilities at Portsite and to the Trestle-Channel Alternative. This is considered conservative based on the similarity of the system components and analysis of historical spill data generated from 1995 to 2001 that shows that over that 7-year period, both spill frequency and magnitude at DMT were below statewide averages. Spill frequencies and magnitudes for the NAB are higher. Additionally, long-term trends in overall rates of fuel spills and spills to water in Alaska, the United States, and the world indicate that spill rates are consistently decreasing over time.

- The spill rate associated with the Breakwater-Fuel Transfer Alternative would be composed of the statewide average spill rates for regulated terminal/storage facilities and a small portion of the spills associated with pipelines to account for the increase in overall pipeline length. Additionally, the spill rate should be increased by a factor to attempt to compensate for the components, particularly the submerged receiving manifold that would be more complex, susceptible to damage, and difficult to inspect and maintain. Based on the relatively small increase in length (about 1.5 miles more than the existing system) relative to a total of about 1,100 miles of petroleum pipeline operated in Alaska, and considering the fact that an act of vandalism accounted for 61 percent of the volume spilled from pipelines during the referenced period, a conservative estimate of 0.1 percent of the statewide average pipeline spill volume is included in the calculation used to estimate the breakwater-fuel transfer spill rate. Based on the nature and complexity of the system and its operation and the susceptibility of some components of the pipeline to damage, the base spill rate for the breakwater-fuel transfer system is increased by a factor of 5. Although the factor of 5 is somewhat arbitrary, it attempts to estimate the relative risk associated with a longer and larger diameter pipeline that can not be inspected and has unusual components that are more susceptible to damage while at the same time considering the particularly strong influence that component failures have on fuel spill rates in Alaska.

- The risk of fuel spills associated with the facilities at Portsite represents 1/2 of the overall spill risk for the fuel that is transferred though the facilities. This is considered conservative because the fuel consumed in the State of Alaska typically must be transferred at least 2 times between distillation at the refinery and final consumption. It also assumes that all the risk is attributable to the transfer process. In most cases, it is transferred more than 2 times and part of the spill risk is shared and is attributable to storage and transportation activities outside the Portsite vicinity.

- Half the spills at Portsite would be spilled to water. Based on existing data that show that no significant spills to water have occurred at Portsite, this is a very conservative assumption. Additionally, transfers to and from vessels are comparatively infrequent relative to other transfers at Portsite. Although transfers to vessels would increase under both construction alternatives, the total number of transfers to vessels would probably be less than 20 per year (based on 30 million gallons transferred annually to barges that typically hold 1 to 5 million gallons).

- The total spill rate calculated for the facility is composed of a single large spill. This is a conservative assumption because the actual spill rate is composed of all spills. Thus the frequency of a large spill would be overestimated.

In addition to fuel storage and transfer operations, accidents on and involving tanker vessels and/or the tugs and barges used for ore concentrate loading present a potential for spills that should be considered. Spill data associated with spills from tanker vessels during transportation are available. However, spills from accidents involving non-tanker vessels are rare and the causes are so dependent on local conditions that it is not possible to predict them with useful certainty.

Existing ore concentrate loading operations are described in the draft Interim Feasibility Report. For safety reasons, current operational procedures at Portsite do not permit ore concentrate barge loading operations at the southern barge loader while fuel is being off-loaded. Under the Third Barge Alternative, the fuel distribution patterns would not change, but the intensity of barge and tug traffic would increase earlier in the season and during some loading operations. Under the Breakwater-Fuel Transfer Alternative, the vessels involved with fuel offloading activities would be separated by increased distance from ore-concentrate loading operations. However, the large amount of traffic would still be present nearby. Under the Trestle-Channel Alternative, the barge traffic associated with existing ore concentrate loading operations would be eliminated along with the associated risk of collisions.

Tanker vessels are highly regulated and their operations are closely scrutinized. As a result, accidents and spills are relatively infrequent. Between 1995 and 2001, 5 percent of the spills in Alaska and about 2 percent of the spilled volume was spilled from tanker vessels. Average spill volumes from tanker barges and tanker ships were 164 gallons and 19 gallons, respectively. The total statewide spill volume from all tanker vessels during the 7-year period was about 15,000 gallons. To calculate an overall spill rate of spills to water from accidents on and involving tanker vessel operations, the following assumptions have been made.

- The statewide average fuel spill rate for tanker vessels during transportation is applicable to vessels transporting fuel to Portsite. This is considered a conservative assumption based on the fact that the average statewide rate includes significant transportation along dangerous river systems.

- Half the volume of fuel spilled from tanker vessels during transportation would be spilled at Portsite. This is considered a conservative assumption because the risk of an accident and associated spill would actually be spread over the entire path that the fuel was transported.

- All the fuel spilled would be released to water. This is a conservative assumption because all or some of the volume spilled could be contained on the vessel and not released to water.

Very little useful data exists to quantitatively calculate the spill rates associated with non-tanker vessels operating at Portsite. The vessels are unique and their operations are unusual. If only site-specific data were used, the lack of fuel spills would indicate that there is no risk. However, the ore concentrate lightering barges carry up to about 75,000 gallons of diesel fuel and operate unprotected in extreme conditions. The fuel stored on the barges is used for annual mobilization and demobilization between Portsite and Puget Sound and tug and on-board loader operations offshore of Portsite. To assess the potential of marine-based spills at Portsite that are not related to tanker vessels, the history of Portsite-related activities was surveyed to determine where circumstances would most likely contribute to accidents and spills. The survey resulted in the identification of a single incident that probably best represents the greatest overall risk of fuel spills from non-tanker vessels near Portsite. In October 2002, the ore concentrate lightering barge *Kivalina* broke loose from its tug during a storm and became grounded on the beach near Portsite in seas up to 20 feet and winds up to 60 knots. Although no fuel was spilled and the barge survived the storm intact, it contained 22,000 gallons of diesel fuel at the time of the incident. Due to the nature of the work, operational conditions, the large number of loading events, and the lack of protected moorage similar accidents probably represent the greatest risk of large spills to water at Portsite. However, it is not possible to quantitatively calculate spill rates for this activity with available data. Thus, this analysis attempts to qualitatively apply the general risk associated with the existing conditions and relate that risk to the anticipated changes that would result from the proposed construction alternatives and convey a relative level of risk relative to each alternative.

7.1 Existing Facility

Spill Rate for Terminal Storage/Transfer Facilities. Between 1995 and 2001 an average of 1,898,224,000 gallons of petroleum was consumed in Alaska each year. During that time, regulated terminal storage/transfer facilities statewide spilled a total of 44,718 gallons or an average of about 6,400 gallons per year. By dividing the average annual volume spilled at similar facilities statewide by the average annual volume consumed statewide, the statewide average spill rate for regulated terminal/storage facilities is calculated to be 0.0000034. Based on this rate, about 3.4 gallons of fuel would be spilled at similar facilities for every 1 million gallons consumed in the State of Alaska.

Assuming that all the spills occurred during transfers and that the fuel was, on-average, transferred 2 times prior to consumption, the average spill rate for an individual regulated storage/transfer facility was about 1.7 gallons per million gallons processed. For comparison purposes, this rate can be compared with the historical spill rates at Portsite and the spill rates associated with crude oil production in northern Alaska and Canada and the volume transferred through the Trans-Alaska Pipeline.

Portsite facilities spilled a total of 710 gallons of petroleum between 1995 and 2001. Of that, 159 gallons were fuel. The remaining volume (551 gallons) was primarily hydraulic oil and lubricants that are not processed through the system and are generally associated with ore concentrate loading operations rather than fuel-related operations. Based on the159 gallons of fuel spilled over a 7-year period and an average annual throughput of about 20 million gallons, the average spill rate for the Portsite facilities was 1.1 gallons spilled per million gallons processed. Based on a study and report by the U.S. Department of Interior, Minerals Management Service in April 2000 (MMS 2000), about 52 gallons of crude oil are spilled during large spills (greater than 4,200 gallons) for every 1 million barrels (42 million gallons) of crude oil produced. This equates to a rate of about 1.2 gallons spilled for every million gallons of crude oil produced on the North Slope of Alaska and transported through the pipeline. Although this crude oil spill rate is artificially reduced because it ignores small spills, the crude oil is transferred over 800 miles of pipeline and the similarity of the three rates support the reasonableness of the rate calculated for average fuel spills at regulated storage/transfer facilities in Alaska.

Based on the statewide average spill rate of 1.7 gallons spilled per million gallons processed at individual storage/transfer facilities and the current annual throughput of 20 million gallons at Portsite, the predicted spill rate of fuel to water from storage and transfer facilities at Portsite would be 34 gallons per year. If it was assumed that half the volume spilled at Portsite would be spilled to water, the predicted average annual release to water would be 17 gallons.

Spill Rate from Tanker Vessels. Based on statewide spill data, the fact that only about 0.6 percent of the fuel consumed in the state is currently transported to Portsite in tanker vessels and the fact that no significant volume of fuel has been spilled to water at Portsite since operations began, the overall operational risk associated with tanker vessels is relatively low. In 2001, about 1.8 billion gallons of fuel were transported through Alaskan Ports (USACE 2002). That indicates that about 84 percent of the volume of fuel consumed in Alaska is transferred through Alaskan ports. Of the volume transferred through Alaskan ports, about 1 percent is currently transported to Portsite in tanker vessels. Applying those values to average spill rates associated with all tanker vessels in Alaska yields an average spill rate of about 22 gallons per year for the volume of fuel that is transferred through Portsite facilities. Conservatively assuming that half of that volume would be spilled at Portsite would reduce that rate to about 11 gallons per year. Because both construction alternatives would shift fuel delivery operations from tanker barges to tanker ships, it is worth noting that studies of world-wide and nationwide spill rates and trends in fuel spills indicate that shipping bulk fuel in tanker ships is generally safer than shipping bulk fuel in tanker barges (Wayne K. Talley & Di Jin Hauke Kite-Powell 2004, http://www.oduport.org/Oilspillpaper.htm). This conclusion is generally supported by data generated in Alaska, but because so many Alaskan ports are inaccessible to large tanker ships, direct comparisons cannot be made and no adjustments are applied to the spill rates.

Spills from Non-Tanker Vessels. Although spill rates associated with the existing fleet of non-tanker vessels cannot be reliably calculated using existing data, it is clear that the potential for a significant spill exists. The accident in October 2002 occurred after approximately 13 years of operation. If it was assumed that an accident similar to the beaching of the *Kivalina* in 2002 would happen once every 15 years and that half of the accidents would result in the release of half of the 75,000-gallon volume stored at the beginning of the season, about 37,500 gallons would be released every 30 years. The annual spill rate would be about 1,250 gallons per year. That annual rate is about 100 times the rates calculated for storage and transfer facilities and tanker vessels. Although this rate cannot be supported with actual spill data, the hypothetical scenario illustrates the potential for spill rates from non-tanker vessels to eclipse the spill rates associated with all other sources. Although quantitative analysis is not possible, the general risk associated with the existing conditions is used as a basis for qualitatively comparing the relative risk associated with the other alternatives.

7.2 Third Barge Alternative

The Third Barge Alternative would simply add an additional lightering barge and one or two additional tugs to existing ore concentrate loading operations. It would not change the volume of fuel transferred through Portsite or change existing regional fuel distribution patterns.

Spill Rate for Terminal Storage/Transfer Facilities. The Third Barge Alternative would not change existing storage and transfer facilities or operations. Thus, the predicted spill rate to water would be 17 gallons per year (same as existing conditions).

Spill Rate from Tanker Vessels. The Third Barge Alternative would not change the volume of fuel delivered, the way it is received or transferred or the number or type of tanker vessels delivering fuel to Portsite. Thus the predicted spill rate to water would be 11 gallons per year (same as existing conditions).

Spills from Non-Tanker Vessels. The risk of fuel spills associated with the operation of the existing fleet of tugs and barges to load ore concentrate would be generally increased due to the increased exposure of the additional barge and the increased vessel traffic associated with the additional tugs and barges. However, the basic ore concentrate loading operation would not change significantly and the anticipated increase in spills from non-tanker vessel accidents cannot be precisely quantified. In general, a minor increase in fuel risk, relative to existing conditions, would be anticipated.

7.3 Breakwater-Fuel Transfer Alternative

The Breakwater-Fuel Transfer Alternative includes an 11,000-foot buried 20-inch pipeline between the existing storage facilities and a submerged receiving manifold that would receive fuel through a flexible line that would be raised to the surface each time it was used and replaced after transfer operations. The flexible line would be removed at the end of each season to avoid damage and the pipeline would be charged with air over the winter. Ships and barges delivering fuel would tie off to offshore anchor points rather than being secured to a dock. The new fuel facilities would likely change existing fuel distribution patterns, reduce the number of shipments needed to deliver fuel to the region, and increase the volume of fuel processed and number of transfers at Portsite facilities. However, neither the volume of fuel delivered to the region nor the total number of transfers required to distribute it would change significantly. The new breakwater would provide protected moorage during severe and dangerous weather and sea conditions.

Spill Rate for Terminal Storage/Transfer Facilities. If constructed, the Breakwater-Fuel Transfer Alternative would increase the annual volume transported to and transferred through Portsite facilities from about 20 million gallons per year to about 50 million gallons per year. Without adjustments to compensate for changes in facility components or operations, the increased volume processed would increase the annual predicted spill volume at Portsite from 34 gallons per year (under existing conditions) to about 85 gallons per year.

To attempt to compensate for the significant differences in fuel storage and transfer system components and operations associated with the Breakwater-Fuel Transfer Alternative, 0.1 percent of the annual average volume spilled from all pipelines in Alaska is added to the predicted annual spill volume to calculate the approximate spill rate. Then, that rate is multiplied by a factor of 5 to compensate for differences in complexity, access, leak detection, and maintenance.

Between 1995 and 2001, the average annual volume spilled from all pipelines in Alaska was about 66,440 gallons. Therefore 65 gallons should be added to the annual spill volume predicted under current conditions at Portsite. Adding 66.4 gallons to the predicted annual spill volume of 85 gallons per year yields a predicted annual spill volume of about 150 gallons. Applying a factor of 5 yields a total predicted annual spill volume of about 750 gallons and a predicted spill rate to water of about 375 gallons per year.

Spill Rate from Tanker Vessels. Based on the increase in volumes transported, the predicted average annual release to water from tanker vessels would increase from 11 gallons per year to about 28 gallons per year. However, the new rate does not consider the likelihood that spill rates would be reduced by the shift of fuel deliveries from tanker barges to tanker ships or the associated reduction in the number of transfer events required to deliver the same amount of fuel.

Spills from Non-Tanker Vessels. The risk of fuel spills associated with the operation of the existing fleet of tugs and barges to load ore concentrate would be generally decreased due to the protection provided by the breakwater. However, the basic ore concentrate loading operation would not change significantly and the decrease in spills from non-tanker vessel accidents cannot be precisely quantified. In general, a moderate reduction in fuel risk, relative to existing conditions, would be anticipated.

7.4 Trestle-Channel Alternative

The Trestle-Channel Alternative would construct a new 1,450-foot trestle from existing shore-based facilities to a new loading platform, a 3.5-mile channel from the loading platform to the -53-foot MLLW depth contour and a berthing area and turning basin adjacent to the loading platform to allow maneuvering of large ocean-going bulk freighters and tankers. The new ore concentrate loading facilities would eliminate the need for lightering barges by allowing direct loading of bulk freighters at the loading platform. The new fuel facilities would likely change existing fuel distribution patterns, reduce the number of shipments needed to deliver fuel to the region, and increase the volume of fuel processed and number of transfers at Portsite facilities. However, neither the volume of fuel delivered to the region nor the total number of transfers required to distribute it would change significantly.

Spill Rate for Terminal Storage/Transfer Facilities. If constructed, the Trestle-Channel Alternative would increase the annual throughput of the Portsite facilities from about 20 million gallons per year to about 50 million gallons per year. Based on statewide spill rates and the increase in volumes transferred and stored, the predicted average annual release to water from storage and transfer operations would increase from 17 gallons per year to about 43 gallons per year.

Spill Rate from Tanker Vessels. Based on the increase in volumes transported and delivered to Portsite, the predicted average annual release to water from tanker vessels would increase from 11 gallons per year to about 28 gallons per year. However, the new rate does not consider the likelihood that spill rates would be reduced by the shift of fuel deliveries from tanker barges to tanker ships or the associated reduction in the number of transfer events required to deliver the same amount of fuel.

Spills from Non-Tanker Vessels. If constructed, the Trestle-Channel Alternative would eliminate the existing tug and lightering barge operations and the associated risk of fuel spills from accidents. Overall vessel traffic would be reduced significantly.

8.0 Predicting Spill Frequency

A common spill scenario was developed to provide a better basis for comparing the relative risks of the three alternatives and the existing conditions. The USCG's WCD, MMPD, and AMPD are used to determine response-planning requirements for spills to water. They have been generated to attempt to predict the worst-case, maximum probable and average most probable discharges from facilities that are regulated by the USCG. The WCD for the existing facility, the Trestle-Channel Alternative, and the Breakwater-Fuel Transfer Alternative are 40,000 gallons, 46,000 gallons, and 199,000 gallons, respectively. Based on a spill rate of 43 gallons per year and conservatively assuming no small spills would occur, a spill of 40,000 gallons would be expected to occur at Portsite every 2,300 years under existing conditions. Clearly, this is an unlikely scenario and that is why the USCG has developed the MMPD and AMPD. As the practical worst-case scenario for storage and transfer activities, this analysis uses the MMPD volume associated with the existing conditions (4,000 gallons). Based on the conservatively predicted frequencies associated with fuel storage and transfer and tanker vessel operations, the 4,000-gallon diesel fuel spill is considered a reasonable possibility and an approximation of the reasonable worst-case scenario. If higher volumes were assumed, the frequencies of the spills would decrease to levels that would make them too unlikely to consider reasonable enough to evaluate. For consistency, this scenario is also used as a basis to evaluate response capabilities and potential environmental impacts from fuel spills. Although a significantly larger spill could occur at Portsite, it appears to be much more likely to result from a vessel accident than from fuel transportation or transfer/storage operations.

8.1 Terminal Storage/Transfer Facilities

Using existing annual throughput volumes and calculated spill rates based on conservative assumptions, a 4,000-gallon storage/transfer related spill to water would be predicted to occur every 235 years under the existing conditions and Third Barge Alternative. Applying the same assumptions and accounting for the anticipated increase in annual throughput and changes in spill rates yields predicted spills to water of 4,000 gallons once every 11 years and once every 93 years for the Breakwater-Fuel Transfer and Trestle-Channel Alternatives, respectively. Therefore, it can be conservatively predicted that one spill (to water) related to fuel storage/transfer operations of about 4,000 gallons may occur sometime during the life of the Trestle-Channel Alternative, and several may occur over the life of the Breakwater-Fuel Transfer Alternative.

8.2 Tanker Vessels

Based on a conservatively estimated spill rate of 11 gallons per year at Portsite for spills associated with tanker vessel operations and assuming all that risk is associated with a single 4,000-gallon spill, a 4,000-gallon spill from a tanker vessel would be predicted to occur about once every 364 years. If the volume transported to Portsite in tanker vessels was increased to 50 million gallons per year as predicted for both proposed construction alternatives, the 4,000-gallon spill would be conservatively predicted to occur about once every 146 years. Assuming a 50-year project life, there is about a 14 percent chance of a 4,000-gallon transportation-related fuel spill at the existing facilities and under the Third Barge Alternative and about a 34 percent chance of a 4,000-gallon transportation-related fuel spill under both proposed construction alternatives. Therefore it is reasonable to predict that a tanker-vessel-related spill of about 4,000 gallons is possible but not likely to occur over the life of the project.

8.3 Non-Tanker Vessels

Although existing data are not adequate to predict spill frequencies from non-tanker vessels, the logical consequences of changes to the existing fleet and vessel operations can be used to anticipate general impacts to spill frequencies associated with each alternative relative to the existing conditions. The Third Barge Alternative would be expected to increase the frequency of spills from non-tanker vessels near Portsite by adding additional vessel traffic and exposing additional powered and unpowered vessels to the harsh operating and environmental conditions. The Breakwater-Fuel Transfer Alternative would be expected to decrease spills from non-tanker vessels because of the protection afforded by the breakwater. The Trestle-Channel Alternative would be expected to significantly decrease the frequency and magnitude of fuel spills from non-tanker vessels by eliminating the need for lightering barges and the large volume of fuel they carry.

9.0 Response Capabilities

Due to practical limitations on vessel transportation, the risk of a large fuel spill to the Chukchi Sea is almost entirely limited to the open water season. Furthermore, the fuel transfers and the associated tanker vessel traffic would likely be concentrated in the early and mid portions of the shipping season to respond to the needs of communities that have not received fuel since the previous fall and to allow time to redistribute winter fuel supplies to communities before low water levels or ice restrict river transportation. Based on practical limitations, most fuel transfer operations would be performed between late June and mid August. Additionally, shipping and transfer operations that present the greatest fuel spill risks would not be performed during severe conditions.

TCAK maintains an ability to initiate containment and control activities for spills up to about 170,000 gallons. For spills to open water, plans and resources are currently in place to clean up the spill within 72 hours. Spills to water could include spills to the Chukchi Sea, North Port Lagoon or South Port Lagoon. However, because of existing spill containment berms intended to contain upland spills and direct them away from the lagoons, spills to the Chukchi Sea from marine-based components are more likely to occur, would be more difficult to control, and pose a greater threat to a wider area.

Appropriate response to spills using existing protocols, equipment, and supplies currently in place would minimize the impacts associated with a 4,000-gallon spill of diesel fuel at the existing facilities and the trestle-channel facilities. Although it would be complicated by the greater distances involved and the offshore nature of the operations, it is anticipated that effective response planning, and equipment staging could also be developed for the Breakwater-Fuel Transfer Alternative.

The portion of the ODPCP that describes the planning scenarios for water-based spills, summarizes the response actions, and lists the equipment that is stored on-site is provided as Attachment 1. Based on the contents of the existing ODPCP, standard fuel transfer protocols include the predeployment of a containment boom that would immediately provide initial containment down current from the transfer operations. Response scenarios have been developed to respond to spills to the Chukchi Sea ranging from about 400 gallons to about 40,000 gallons. Procedures are in place and personnel have been trained to shut down transfer operations, stop the discharge, contain the spill, identify and protect particularly sensitive areas, recover spilled material, and dispose of the recovered material. In most cases, it is likely that a 4,000-gallon spill to the Chukchi Sea would be almost entirely contained without significant impacts to marine wildlife or contact with undeveloped shorelines.

If a significantly larger spill were to occur, TCAK has access to additional equipment and manpower via its contracts with NANA Lynden Transportation, Alaska Chadux Corporation (ACC), and Foss Marine. NANA Lynden Transportation personnel and equipment are on-site 365 days per year. Foss Marine personnel and equipment are on-site during the ore-concentrate shipping season. Alaska Chadux Corporation is a statewide spill response contractor. As a member of the associated oil spill response co-op, TCAK has the right to access ACC's spill response equipment and trained personnel at a moments notice.

10.0 Anticipated Impacts

The draft EIS provides information about the wildlife and environmental conditions that would likely be present near Portsite between mid June and early August. The environmental damage from a vessel oil spill is difficult to predict. “Because of the interactions of a great number of factors, two spills in the same place will have very different environmental consequences depending, for example, on the time of year, weather conditions, and success of the clean-up" (Dicks, 1998). Prevailing wind and surface currents would likely cause the plume from a large uncontained spill to the Chukchi Sea to migrate north from the spill site at a rate of about 1 mile per hour. Based on EPA guidelines used for ODPCP development, about 15 miles of shoreline north of Portsite is thought to be susceptible to significant damage from a large spill near the DMT. Several small streams and three rivers (Omikviorok, Wulik, and Kivalina) flow into the Chukchi Sea within about 15 miles north of Portsite. Although tidal fluctuations could push the migrating fuel plume a short distance into the mouths of some streams, rivers, and coastal lagoons, under normal conditions, the streams and rivers would not be significantly impacted by a spill because of relatively small tidal fluctuations and because flow from them would oppose plume migration into their mouths and onto adjacent beaches and preclude migration to elevations above the level of the Chukchi Sea.

TCAK has identified these and other particularly sensitive areas, including primary waterfowl staging areas and pre-established containment and diversion boom locations, to protect them (see Attachment 2). In addition to containment and diversion efforts, wildlife-hazing techniques have been developed and would be implemented to minimize the impacts of a spill. Even if initial containment efforts were completely ineffective, impacts to the beaches, rivers, streams, and wildlife near Portsite from a 4,000-gallon spill would be limited by secondary efforts to protect areas of critical habitat and by hazing wildlife from impacted areas. Additionally, the relatively low abundance of wildlife present and the small proportion of the total habitat that would likely be affected would limit impacts from a spill.

Based on the anticipated spill and the likely response, no significant environmental impacts would be anticipated from a 4,000-gallon fuel spill. However, if a spill was not contained, some general fate and transport predictions can be made through which impacts can be estimated. A Diesel Fuel Fact Sheet generated by the National Oceanic and Atmospheric Administration (NOAA) is provided in Attachment 3. It provides information relevant to the fate of diesel fuel spilled to seawater. Although many factors contribute to the initial dispersion characteristics of fuel spills, diesel fuel released to water would generally create a plume on top the water that would move with surface currents but be influenced by winds. Over a relatively short time, the plume would expand across the surface in a thin layer and the volume of fuel would gradually be reduced by evaporation, dispersion, biodegradation, and photo-oxidation. For the purpose of pollution regulation, the ADEC considers diesel fuel to be highly toxic, highly dispersible, and highly degradable (ADEC 2004). Over 90 percent of the fuel from a 4,000-gallon spill would be evaporated or naturally dispersed within a few days (NOAA 2005). Fish and invertebrates that come in direct contact with the fuel spill may be killed. However, similar sized spills in open water have been diluted so rapidly that fish kills have never been reported. Crabs, shrimp, and shellfish in shallow, near-shore areas could become tainted with fuel contaminants but would likely depurate the fuel constituents within several weeks of exposure (NOAA 2005). Marine birds could be impacted, particularly if the spill reached areas with high bird concentrations. Since these areas have already been identified and protective measures have been developed and implemented to protect important bird habitat, to include hazing birds away from affected areas, impacts to marine birds would be minimized. The spilled fuel would probably be completely degraded by naturally occurring microbes within 2 months during open water conditions. Although cold temperatures and ice would slow the degradation process associated with a spill very late in the shipping season, the degradation process would continue during the fall and winter and would probably be complete prior to spring marine mammal migrations.

If 4,000 gallons were spilled and spread evenly over the water in a layer ½-inch thick, it would cover an area of about 0.3 acre. If it was not contained and the entire volume was immediately washed ashore, up to about 15 acres of beach habitat could be covered with a layer of fuel averaging about 1/100-inch thick. If the impacted portion of the beach averaged 50 feet in width, approximately 2.5 miles of beach habitat would be significantly impacted. However, most of the fuel would evaporate or naturally disperse within a few days. Additionally, the beaches near Portsite are comprised primarily of coarse sand and gravel and the harsh conditions prevent the establishment of significant biological assemblages within the active portion of the beach. The physical nature of the beach and the lack of organic material would limit the potential effects and speed beach recovery rates. Based on typical wind and current conditions present during the open water season, it is unlikely that a 4,000-gallon spill at Portsite would impact beaches greater than about 10 miles from Portsite.

Although a spill significantly larger than 4,000 gallons is very unlikely to result from bulk fuel transportation, storage and transfer operations, vessel accidents present a potential for a large spill that should be considered. Based on an evaluation of the history associated with existing operations, accidents involving vessels currently conducting ore concentrate loading operations probably present the greatest overall risk of large fuel spills to waters near Portsite. Upon mobilization from Puget Sound each spring, the lightering barges generally each hold about 75,000 gallons of fuel used for tug and on-board loader operations. Based on estimates of fuel used by the four accompanying tugs in transit to the site and the fact that the severe conditions that would likely contribute to a serious accident would most likely occur in the fall when the fuel volume stored on-board would be lower, a conservative estimate of the potential magnitude of a spill is about 50,000 gallons. The impacts from fuel spills of this magnitude would be much greater than those predicted for the 4,000-gallon spill.

Based on diesel fuel weathering rates developed for spills associated with oil production in the Beaufort Sea (MMS 2000), most diesel fuel spilled to water near Portsite during the summer would likely dissipate within about a week. Table 6 presents the predicted temporal fate of a diesel spill in the Chukchi Sea based on data generated in the Beaufort Sea. The conditions that would influence the fate of the fuel in the Beaufort Sea off the North Slope closely resemble those of the Chukchi Sea.

Table 6
Estimated Fate of Diesel Fuel Spilled to the Chukchi Sea

Time After Spill (Days)	1	3	7
Fuel Remaining (%)	51	14	2
Fuel Dispersed (%)	38	68	78
Fuel Evaporated (%)	11	18	20

Initial response to a 50,000-gallon fuel spill would probably contain most of the fuel, recover a significant portion of it, and prevent significant environmental impacts away from Portsite. However, if initial response activities were ineffective, impacts could be wide spread. Under typical conditions during the shipping season, an uncontained 50,000-gallon fuel spill would be expected to significantly impact 10 to 15 miles of shoreline habitat north of Portsite. Secondary efforts to contain, recover, and divert the fuel would likely minimize impacts to the most sensitive areas and hazing would probably prevent some animals from being injured or killed. However, an uncontained 50,000-gallon spill would significantly impact several miles of beach habitat making it unusable to wildlife for about a week. During that time, the acute effects would be highly dependent on the effectiveness of the secondary efforts to control the plume and protect the wildlife present. After about a week, most the physical hazards associated with the fuel would dissipate and the cleanup efforts would become less effective than natural dispersion and degradation. Based on the predicted fate of the spilled fuel, the effects would gradually shift from acutely toxic and physical effects such as oiling to more chronic effects from non-lethal exposures. Dispersion within the water column would probably return near-shore water quality to near-normal levels within a few weeks, facilitating beach recovery within impacted areas. Chronic effects may be observable for up to a year at some highly impacted beach locations but would probably decrease rapidly after a few months in less impacted areas.

11.0 Conclusions.

Historical spill reports indicate that most fuel spills in Alaska are caused by structural or mechanical component failures. Component failures caused about 60 percent of the spills and accounted for about 85 percent of the volume spilled at Portsite between 1995 and 2001. Human factors are the second most common cause of fuel spills in Alaska and were associated with about 20 percent of the spills and 14 percent of the volume spilled at Portsite during the same period. Tanker vessels are not typically significant sources of spills. Between 1995 and 2001, spills from tanker vessels (ships and barges) accounted for about 5 percent of the total spills and about 2 percent of the total volume spilled in Alaska. Although large spills from vessels are rare, they usually account for a large percentage of the yearly accidental vessel spillage. No significant fuel spills from vessels have been reported at Portsite. The risks associated with fuel spills to water near Portsite are primarily related to bulk fuel processing and ore concentrate loading operations. Risks associated with both sources should be considered in the overall analysis. These risks are composed of spill frequency, magnitude, and impact.

11.1 Spills From Bulk Fuel Processing

Applying reasonable assumptions to estimated spill rates developed for individual bulk fuel system components of facilities operating and/or proposed to be constructed at Portsite allowed the calculation of a relative risk of significant spills associated with each alternative.

Table 7 presents the relative risk, expressed as a percentage, that an assumed 4,000-gallon diesel spill to water would result from bulk fuel storage/transfer components and tanker vessel accidents associated with each of the alternatives over an assumed 50-year project life. The risk was calculated by dividing the assumed 50-year project life by the calculated annual spill rate for each primary component. The risks presented are considered high estimates because of the conservative assumptions that generated the spill rates and the fact that small spills that would comprise a portion of the average annual spill rate were not included in the calculation. It should also be noted that the assumed spill volume is based on the USCG's maximum most probable discharge volume associated with the existing facilities. The common spill volume was selected to permit the comparison of the relative risks of each alternative. Actual differences in spill rates and relative risk would be manifested in differences in both spill frequency and magnitude.

Table 7

Relative Risk of a 4,000-gallon Fuel Spill to Water

	Alternatives			
	Existing Conditions	**Third-Barge**	**Breakwater-Fuel Transfer**	**Trestle-Channel**
Storage/Transfer	21%	21%	455%*	54%
Tanker Vessels	14%	14%	34%	34%

* The calculated risk exceeds 100% because the predicted frequency for the Breakwater-Fuel Transfer Alternative is once every 11 years.

11.2 Spills From Non-Bulk Fuel Vessels

In addition to spills from bulk fuel system components, the analysis identified a significant risk associated with spills from the existing fleet of vessels performing ore concentrate loading operations. This risk cannot be quantified using existing data but the nature of the operations and the accident history at Portsite provide a basis for concluding that accidents involving the lightering barges probably present the largest risk of significant fuel spills to marine waters at Portsite. Analysis of the accident involving the lightering barge *Kivalina* in October 2002 illustrates the potential for the risk of spills from non-tanker vessels operating at Portsite to outweigh the risks associated with bulk fuel processing activities. This conclusion is probably particularly applicable to larger spills (greater than 4,000 gallons). Although existing data are not adequate to predict spill frequencies from non-tanker vessels, the logical consequences of changes to the existing fleet and vessel operations can be used to anticipate general impacts to spill frequencies and magnitudes associated with each alternative relative to the existing conditions.

Third Barge Alternative. In general, the Third Barge Alternative would moderately increase the frequency of spills from non-tanker vessels near Portsite by adding additional vessel traffic and exposing additional powered and unpowered vessels to the harsh operating and environmental conditions. It would not likely impact spill volumes associated with the existing conditions because the new barge would likely be very similar to the existing barges.

Breakwater-Fuel Transfer Alternative. The Breakwater-Fuel Transfer Alternative would decrease the overall frequency and magnitude of spills from non-tanker vessels because of the protection afforded by the breakwater.

Trestle-Channel Alternative. The Trestle-Channel Alternative would be expected to significantly decrease the frequency and magnitude of fuel spills from non-tanker vessels by eliminating the need for lightering barges and the large volume of fuel they carry.

11.3 General Conclusions

Based on quantitative and qualitative analysis of the existing conditions and three proposed alternatives, the highest overall risk of fuel spills to water near Portsite would probably result from the construction of the Breakwater Fuel-Transfer Alternative. This conclusion is based on the fact that the new bulk fuel processing system would be more complex, less accessible for maintenance and inspection, and transfer more fuel than the existing system. Although the breakwater would provide protected moorage, the existing loading operations would not change significantly and the longer and larger diameter pipeline would probably increase the risk of larger spills farther offshore where containment may be more difficult. Of the remaining three alternatives, the third barge alternative presents the next highest level of risk of spills to water near Portsite due to the additional risk associated with the additional barge and tug traffic. The two remaining alternatives present a similar level of risk of fuel spills to water near Portsite. Although the Trestle-Channel Alternative would eliminate the need to expose the lightering barges to operating conditions that could damage them, the volume of fuel and the number of fuel transfers at Portsite would increase significantly over existing conditions. However, from a regional perspective, the Trestle-Channel Alternative presents the lower level of risk of fuel spills to water because of the decrease in the total number of tanker vessel trips needed to supply fuel to the region. Additionally, tanker ships are generally safer to operate than the tanker barges (Talley & Kite-Powel, 2001) that are currently used to supply fuel to Northwest Alaska.

12.0 References.

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Attachment 1

Excerpts from Red Dog Mine
Oil Discharge Prevention and Contingency Plan

Table 6-1 Dedicated Spill Response Equipment.*

Equipment	Port Trailer	Port Connex	Mine Trailer	Mine Connex
Response Vessels				
20-foot Aluminum Weld Boat with motor (2-70 HP) (Port Site)				
30-foot Spill Response Vessel w/Twin 150 HP (see Photo 1) (Port Site) 26-foot Spill Response Vessel w/ Volvo Penta (Diesel) (Port Site)				
Recovery				
Sorbent pad packs 17" x 17" (50/bag)	5 bags	90 bags	10 bags	100 bags
Sorbent Rolls (38" x 144' each)	6 rolls	6 rolls		70 rolls
Sorbent Boom (40 ft/package)	2 pkgs	50 pkgs	6 pkgs	30 pkgs
Containment Boom		5,000 ft		
Poly liner 38' X 85'	2 rolls			
T-disk skimmer with hydraulic system (22 gpm); Model T-5		1		
Manta Ray Skimmer (120 gpm)	2			
SEAVAC skimmer with suction hoses; Model SV330 (330 gpm)	1			
Drum skimmer; Model 495636		1		
2" double diaphragm air pump (sandpiper) 140 gpm with suction and discharge hoses**; Model Wilden M2 (SA2A-DR5A)		17		4
Diesel American Trash Pump (350 gpm)	1			
Yanmar Diesel Trash Pumps (350 gpm)		3		
Fold-a-Tank, 2,500 gal	1	5		5
Chainsaws, Generators, and Anchors				
36" Stihl chain saw, Model 064	1			1
36" Stihl chain saw bars	3			2
36" Stihl chain saw chains	3			2
Chain and bar oil	6 gal			2
Yamaha generator set	1			1
Wheel kit for generator (on Yamaha)	1			
Anchor Buoy 24-inch Inflatable		4 (on boat)		
Danforth Anchor		4 (on boat)		
1/2" x 200' nylon anchor wire w/eye		1		

Table 6-1 Dedicated Spill Response Equipment (Cont'd).*

Equipment	Port Trailer	Port Connex	Mine Trailer	Mine Connex
Safety Equipment				
Life vests	10		12	
Flares	30			4
Tyvek suits	80		103	
Rubber gloves	100		30	
Neoprene gloves	24		18	
Boots	5			
Rain gear	30		29	
Emersion suit	2			
HAZMAT suits			24	4
Respirators, North full-face, assorted sizes	9		7	5
Respirator cartridges (combo)	20		26	36
First aid kit	1			1
Ear protection	1 box		1 box	1 box
Eye protection	3 goggles		42	10
Air monitor (detects H_2S, O_2, and explosive environment)	1 (Mill Dispatch/Mine Tool Crib)			
Draeger Pump with assorted tubes (detect CO, HCN, H_2S, and SO_2)	1 (Mill Dispatch/Mine Tool Crib)			
Hazing Equipment				
50 gauge cracker shells	Misc.			
15 mm Launch starter pistol	2			
6 mm caps	100			
Mylar tape	5 rolls			
15 mm screamers (green)	100			
15 mm rocket bangers (red)	100			
Birds of Alaska field book	1			
Miscellaneous				
Shovels	1	3		5
Rakes	5			5
Plug Rug	4 rugs			1 rug
Plug N Patch kit	2 kits			1 kit
Leak Lock kit	2 kits			
Standby lighting	1 set			

Table 6-1 Dedicated Spill Response Equipment (Cont'd).*

Equipment	Port Trailer	Port Connex	Mine Trailer	Mine Connex
Safety Equipment (Cont'd)				
Motorola base radio	1		1	1
Plywood 1/2" (to place on tundra)	10			10
Plastic bags	6 boxes			5 boxes
Duct tape			5 rolls	6
Black plastic spill boxes		2		4
Sand bags		50		50
Acid pump				1

* For response times, see Section 1.5, Deployment Strategies.

Contact Loss Control for equipment acquisition at 426-9217.

** **Mine Connex and Mine Trailer contain suction and discharge hoses for sandpiper pumps and SEAVAC skimmers (e.g., 26 each of 250-foot discharge hoses for sandpipers with 100-foot suction hose; 100 feet of suction hose for SEAVAC skimmer).**

Photo 1. 30' Vessel Dedicated for Spill Response.

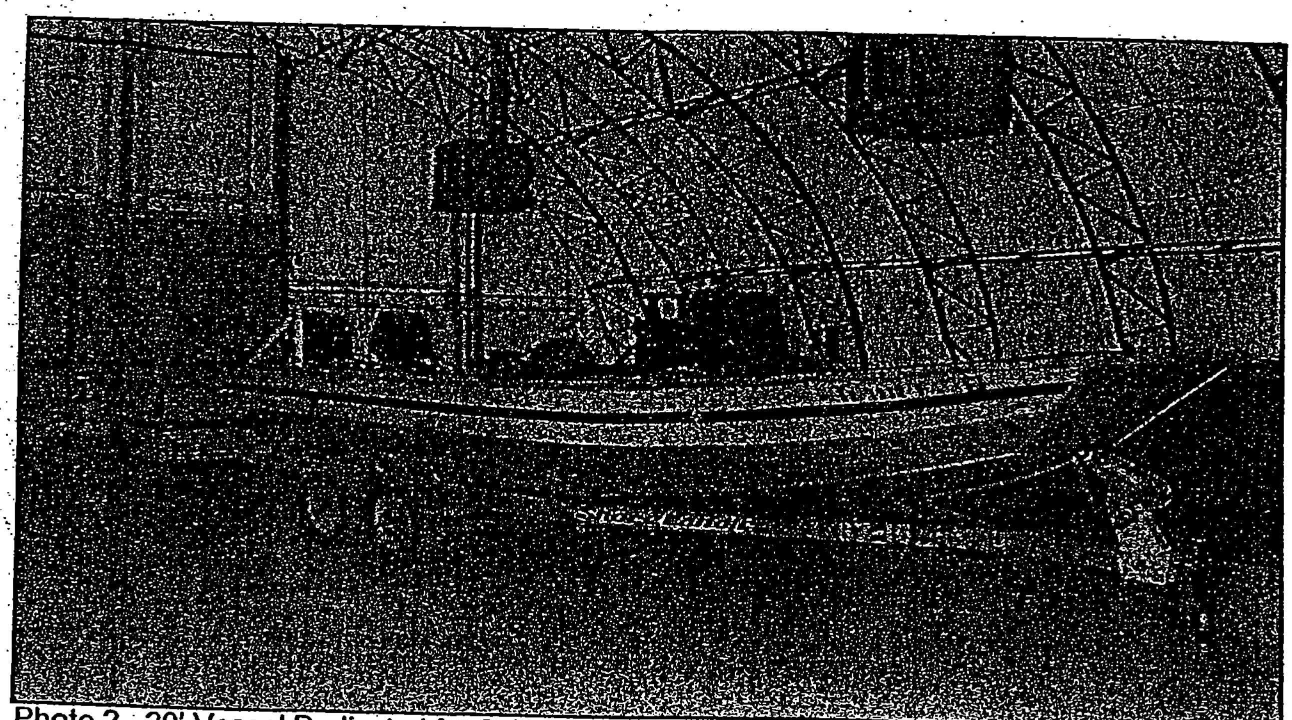


Photo 2. 20' Vessel Dedicated for Spill Response.

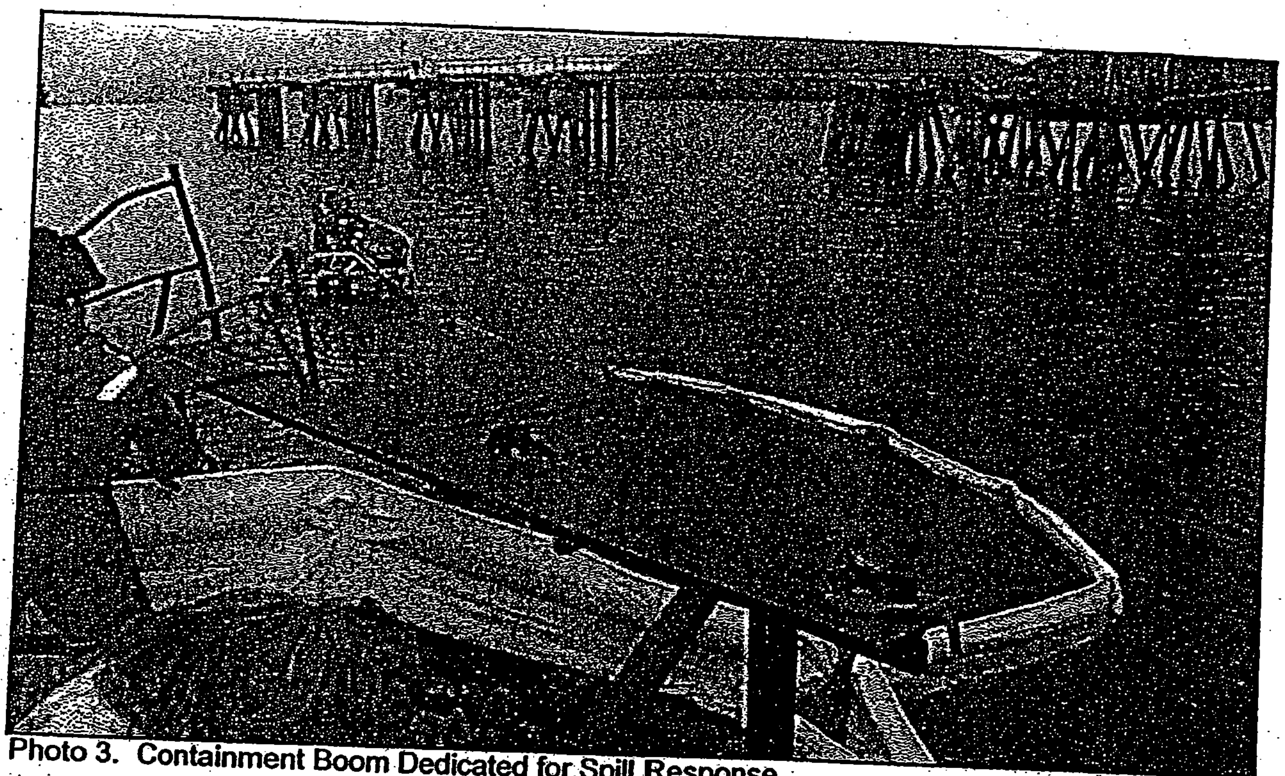


Photo 3. Containment Boom Dedicated for Spill Response.

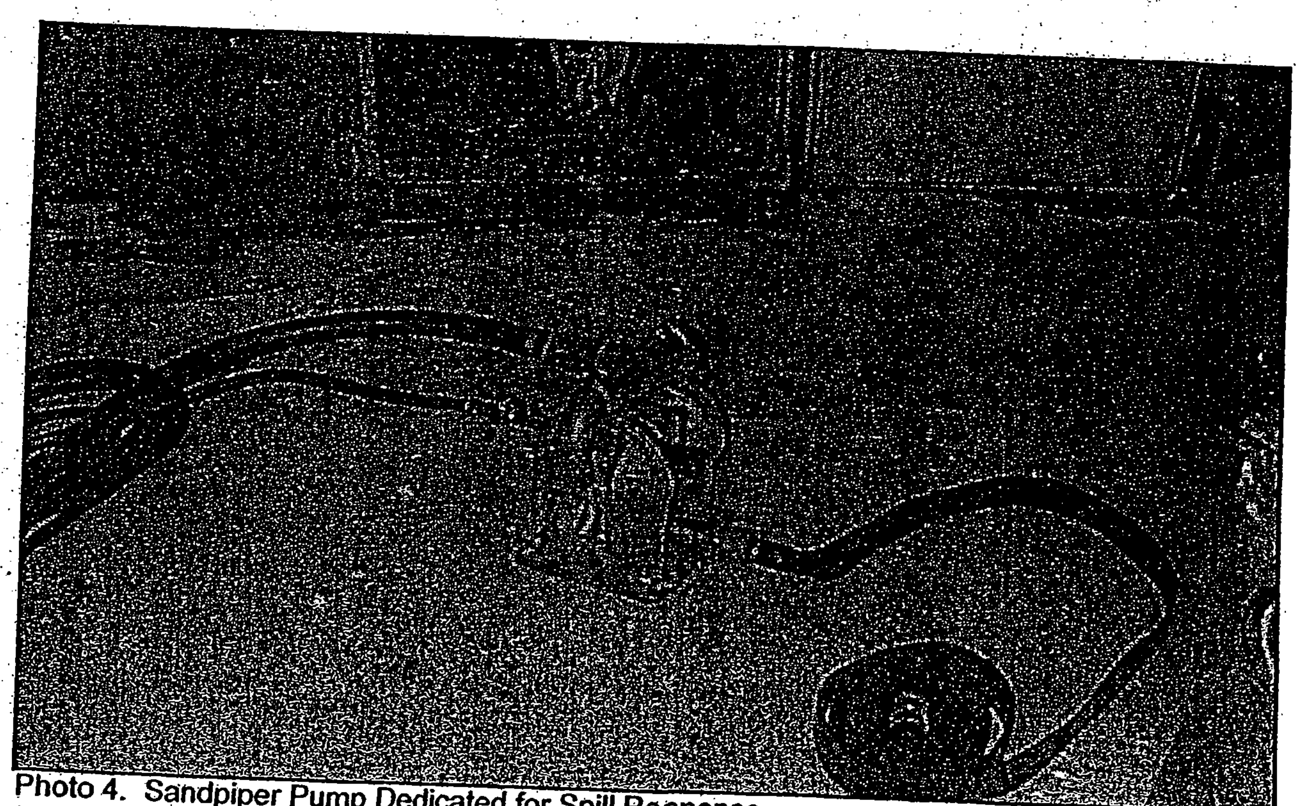


Photo 4. Sandpiper Pump Dedicated for Spill Response.

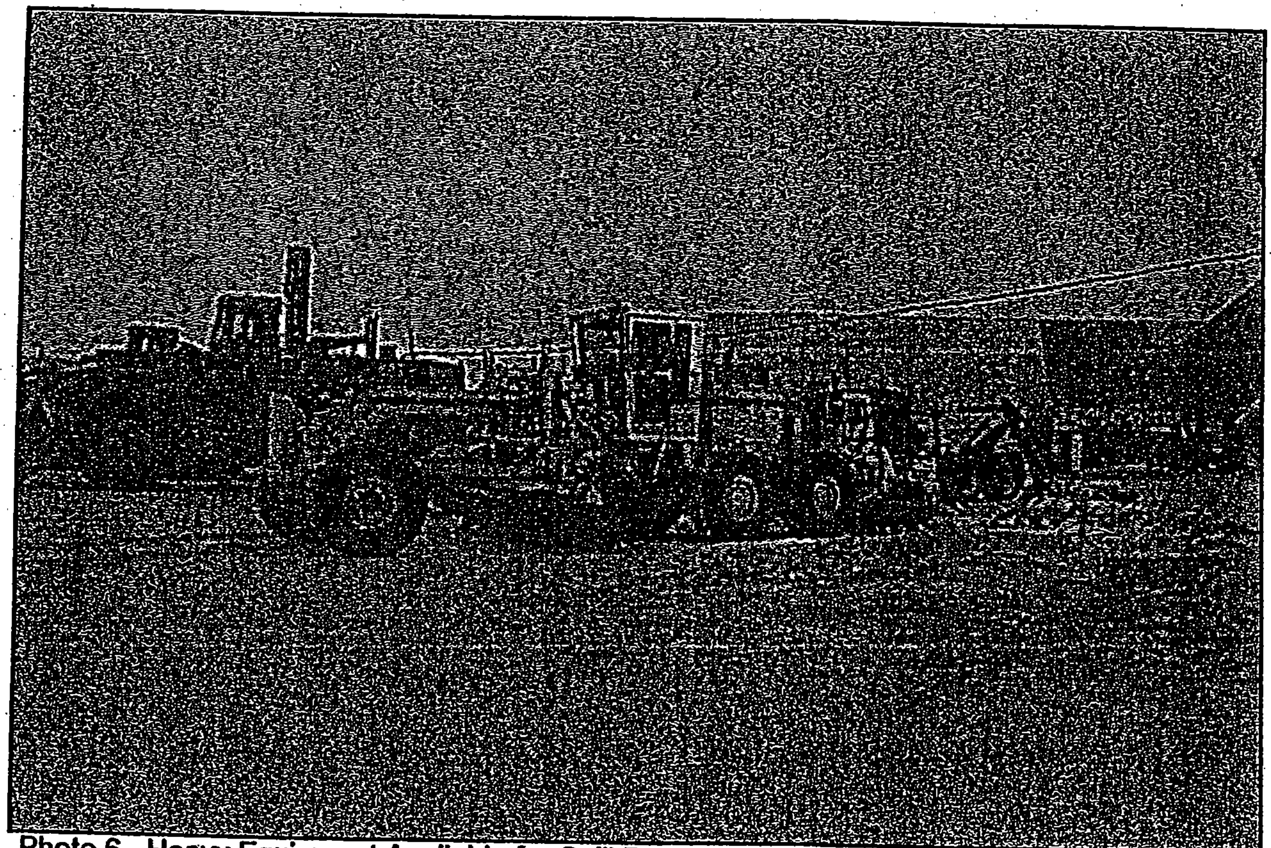


Photo 6. Heavy Equipment Available for Spill Response.

Table 6-1a Spill Response Equipment* This equipment is a subset of all equipment presently at the Red Dog facility and consist of equipment that may be involved in a major spill.

Equipment Description	Port Site		Mine Site	
	Quantity	Location	Quantity	Location
Communications				
Marine Frequency all-channel, hand held radios	5	Various locations		
Mobile radios	7	In various vehicles/equipment**	20	Various locations
Base radios	1	Office	2	Heavy Equipment Tool Crib, Nana Lynden Shop
Aircraft frequency radios***	2	Office	2	Airport
VHF radio, ship to shore	1	Office		
Charger for Marine channel radios	2	Office		
Transport/Storage				
Vac truck, 1,600 gal, 200 gpm	1	Port yard, summer only		
5,000 gallon tank skid mount pull with tractor (Shelly's)			1	Mine Laydown
5,000-gal tank skid mount pull with tractor (Shelly's)	1	Laydown yard		
1,000-gal water tank #6719 mounted on #8215			1	Mine area
500-gal tank skid mount				
Barrel pump - dual action w/8-ft hose	1	Fuel shed		
Gorman Rupp 6" pumps for water	3	Port yard/road		
Logistics-Land (see photo 6)				
18,000 gallon water truck (summer only)			1	Mine pit area
2WD trucks and vans			6	Bull Rails
4WD crew cabs, pickups, vans	4	Port Yard	10	Bull Rails

Equipment Description	Port Site		Mine Site	
	Quantity	Location	Quantity	Location
Medium Duty Trucks			10	Various locations
2WD Light Duty ambulance	1	Port Yard	1	Fire Bay
36 passenger bus			1	Mine Yard
Load logger trash truck			1	Mine yard
Yamaha 4X4 ATV with hitch	1	Port Yard	1	Mine Yard
Yamaha spare parts (front & back)			3	Mine Yard
Yamaha Deck Style trailer with 4'X6' BKD			1	Mine Yard
Snowmobiles			2	Mine yard
600 HP semi-tractors			2	Nana Lynden bay or Port Road
Flatbed or widebed trailer			1	Various locations
85-ton haul truck			2	Mine Pit
Two truck 4X4			1	Mill Maintenance
Garbage Truck			1	Mine Maintenance
R35 haul truck			2	Various locations
5-ton boom truck	1	Port yard/road	1	Bullrail
5th wheel truck			1	Bullrail
5-ton utility van			1	Bull Rail
Low-Boy Trailer			1	Nana Lynden Bay
10 yd dump boxes (require trailers)			3	Mine Laydown yard
Road Sanding boxes (require trailers)			2	Laydown yard
10 CY Sander Truck			1	Mine Yard
Snow Plow Truck (winter only)			2	Mine yard

Backhoe			1	Mine area
Challenger 65 wide-track dozer			1	Various locations
Tracked dozer, D-8N			1	Various locations
16 G Grader			3	1 mine; 2 port road
14G Grader			1	Mine area
13 CY FE loader			3	Mine Pit
3½ and 4 CY FE loader	1	Port CSB	2	Mine Area
5100 Waldon FE loader			1	Mill Operations
7 CY FE loader	1	Various locations	2	Various locations
V900 forklift	1	Various locations	2	Various locations
2 and 2½ ton forklifts			2	Mill operations
4 ton extendable forklift			2	Mine area
5 ton forklift	1	Port Yard		
Crane, 35-ton, P&H			1	Various locations
Command Post HC radio, IC Center, SCBAs	1	Port Office	1	Tool crib
Outboard oil mixture	10	Connex		
Other				
Maxi Light Towers			3	Various locations
Generators			3	Various locations
Heaters (indirect)			2	Various locations
175 CFM compressors	2	Various locations	2	Various locations
125 CFM compressors	1	Various locations	1	Mine area
Connex 20'	Misc.	Port yard	Misc.	Laydown area
Shop tools and equipment	Misc.	Shop	Misc.	Tool crib

*If the equipment is usually used throughout the facility, "various locations" is listed

Equipment that is located in either a spill response trailer or a spill containment conriex is also listed in Table 6.1. For response times see Section 1.9 Response Strategies.

Contact Loss Control for equipment acquisition at 426-9291

Tier 3 Availability

**Approximately 4 passenger vehicles, 10 fork lifts and 20 pieces of heavy equipment have 4-channel radios.
***2 road vehicles also have aircraft frequency channel radios (Loss Control and Surface Crew).

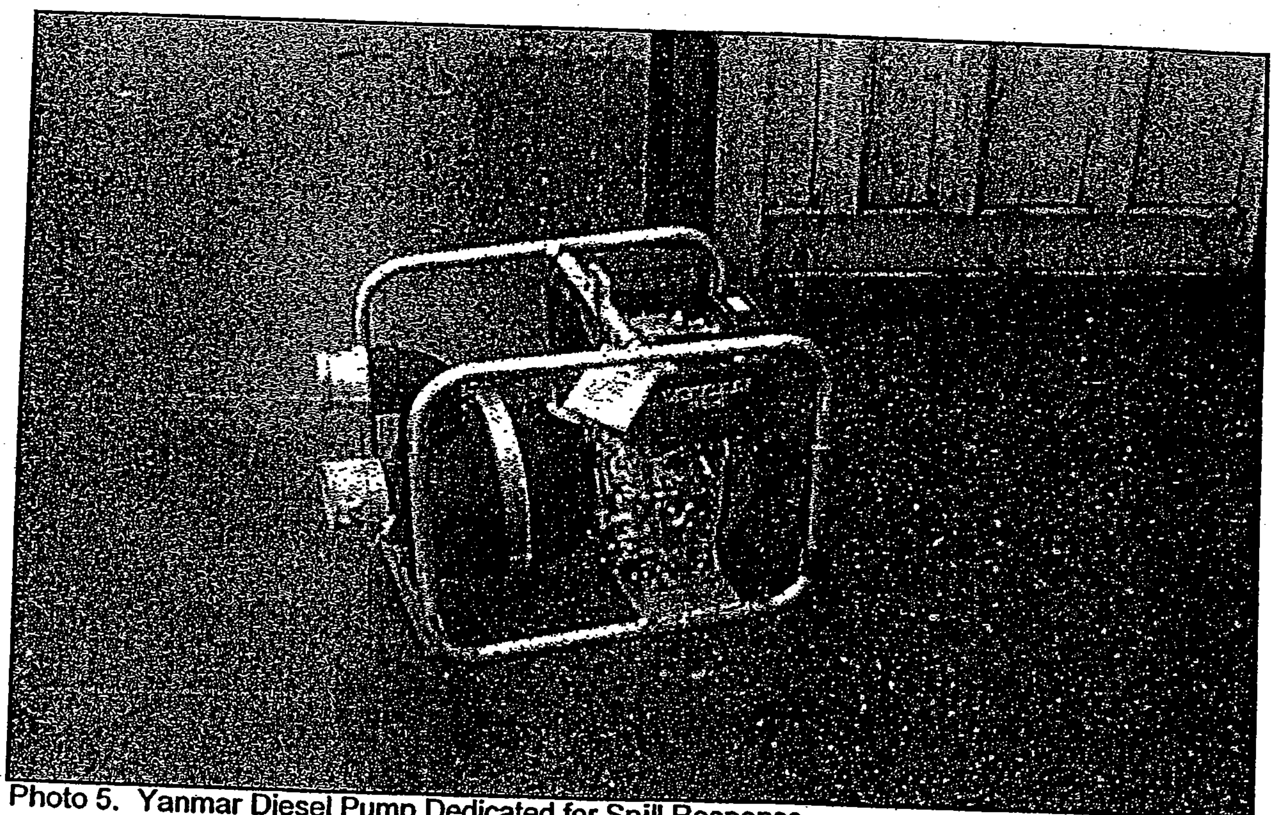


Photo 5. Yanmar Diesel Pump Dedicated for Spill Response.

Table 6-1b Fire Protection Equipment*

Equipment Description	Amount	Location
Firefighting suits	25	Fire Bay
Ranger Knee Fire Boots	25	Fire Bay
Nomex Fire Gloves	25 pr	Fire Bay
SCBA - Air packs Spare bottles	5 5	Fire Engine
SCBA - Air packs Spare bottles	2 2	Ambulance
SCBAs	2 - fully equipped	Spill Trailers (Port Site)
Fire hose**		Mine Site Fire Bay

* For response times, see Part 1, Section 1.5, Deployment Strategies.

Contact the Fire Chief for equipment acquisition at 426-9144 and (fax) 426-2177.

** Consists of 600 feet of 5"; 600 feet of 1.75"; and 1,500 feet of 2.5". In addition to firefighting, the hose is also for washing spilled material or for cooling tanks.

Table 6-2 Nana Lynden Spill Response Equipment

Equipment	Quantity	Use
Tractor Freightliner F-120	13	Concentrate/Fuel/Supply Haul
Chevy C-60	1	Shop Truck/Service Vehicle
Suburban	1	Service Vehicle
Chevy Pickup	1	Service Vehicle
28-yard End Dump	4	Trailer Unit
Side Dump Doubles	8	Trailer Unit
40-foot Flat Deck	6	Supply Haul
24-foot Flat Pups	2	Supply Haul
100-ton Lowbed	1	Supply Haul
5,000-gallon ISO tanks	5	Fuel Supply
Small Hydraulic Crane 5,000 lbs.	1	Small Engine Crane
Cat 988 B Front-end Loader	1	Supply
Sorbent pads (fuel truck)	2 bags	Dedicated Spill Response
Sorbent Boom (fuel truck)	120 feet	Dedicated Spill Response
Sorbent Boom (shop truck)	40 feet	Dedicated Spill Response
1-gallon Tank Patch Kits (fuel truck)	2 kits	Dedicated Spill Response
Shovel (fuel truck)	1	Dedicated Spill Response

* For response times, see Part 1, Section 1.5, Deployment Strategies.

Contact Division Manager at Nana Lynden for equipment acquisition at 426-2160 (fax 426-2161)

Table 6-3 Typical Barge Equipment Available for Supporting Spill Response during the summer*

Contact: Individual Barge

Response Times: 0.5 hour from Port Site Facility

Equipment Description	Quantity
Tug Boats	
Tug Boat	1 ea
14'-16' Lund Skiff Workboat with 15-25 HP outboard motor	1 ea
3" Diesel Trash Pump (350 gpm capacity)	1 ea
75' Suction/Discharge Hose	1 ea
Miscellaneous Absorbent Material and Sheets	

* Equipment type and quantity may vary between barge companies and between barges.

For response times, see Part 1, Section 1.5, Deployment Strategies.

Contact the Fire Chief for equipment acquisition at 426-9144 and (fax) 426-2177.

IC = Incident Commander OPS = Operations Section Chief

1.10.7 ADEC Scenario No. 3--Barge to Port Site Transfer Operations

Location: Cell No. 2
Date/Time: October 3, 1200
Source: A 12-Inch pipeline rupture at dock Cell No. 2 during a fuel transfer to Tank #4 at the Port Site
Quantity Spilled: 22,400 gallons
Type of Product Spilled: Arctic diesel
Spill Trajectory: Fuel flows from the damaged pipeline into the Chukchi Sea. Fuel is flowing at 5,600 gpm (worst case) in a 12-inch diameter pipeline. The spill spreads approximately 200 feet northeast toward the shore.

Cause: A fuel barge is transferring fuel to the Port Site when a 12-inch pipeline cracks at Cell No. 2.

Environmental Conditions: Air temperatures of 10°F at night and 25°F during the day. There is light snow falling, with 6 inches on the ground. The Port Site is ice-free. Sunrise is approximately 0725 and sunset is at 1747 hours. Winds are SW at 10 knots. See Figure 6-2B and Figure 6-3 for illustrations of spill Scenario No. 3.

1.10.8 USCG Scenario No. 3A--Barge to Port Site Transfer Operations (Worse Case Discharge)

Location: Cell No. 2

Date/Time: October 3, 2000
Source: A 12-inch pipeline rupture at dock Cell No. 2 during fuel transfer to Tank #4 at the Port Site

Quantity Spilled: 39,749 gallons

Type of Product Spilled: Arctic diesel
Spill Trajectory: Fuel flows from the damaged pipeline into the Chukchi Sea. Fuel is flowing at 5,600 gpm (worst case) in a 12-inch diameter pipeline. The spill spreads approximately 200 feet northeast toward the shore.

Cause: A fuel barge is transferring fuel to the Port Site when a 12-inch pipeline cracks at Cell No. 2.

Environmental Conditions: Air temperatures of 10 °F at night and 25 °F during the day. There is light snow falling, with 6 inches on the ground. The Port Site is ice-free. Sunrise is approximately 0725 and sunset is at 1747 hours. Winds are SW at 10 knots. See Figure 6-2B and Figure 6-3 for illustrations of spill Scenario No. 3A.

1.10.9 USCG Scenario No. 3B--Barge to Port Site Transfer Operations (Average Most Probable Discharge)

Location:	Cell No. 2
Date/Time:	October 3, 2000
Source:	A 12-inch pipeline rupture at dock Cell No. 2 during fuel transfer to Tank #4 at the Port Site
Quantity Spilled:	398 gallons
Type of Product Spilled:	Arctic diesel
Spill Trajectory:	Fuel flows from the damaged pipeline into the Chukchi Sea. Fuel is flowing at 5,600 gpm (worst case) in a 12-inch diameter pipeline. The spill spreads approximately 200 feet northeast toward the shore.
Cause:	A fuel barge is transferring fuel to the Port Site when a 12-inch pipeline cracks at Cell No. 2.
Environmental Conditions:	Air temperatures of 10 °F at night and 25 °F during the day. There is light snow falling, with 6 inches on the ground. The Port Site is ice-free. Sunrise is approximately 0725 and sunset is at 1747 hours. Winds are SW at 10 knots. See Figure 6-3 for an illustration of spill Scenario No. 3B.

The scenario for the Average Most Probable Discharge (Scenario 3B) is the same as the Worse Case Discharge (Scenario 3A), but with less pumping and storage requirements. Additionally, the OSRO would not be activated.

Response Action Plan

Emergency Action Checklist:	See Part 1, Section 1.1
Reporting and Notification:	See Part 1, Section 1.2
Safety Procedures:	See Part 1, Section 1.3
Communication Plan Implementation:	See Part 1, Section 1.4
Equipment and Personnel Location:	See Part 1, Section 1.5

The header watch (two Teck Cominco Alaska personnel) notices that the pipeline at the header on Cell No. 2 has failed. The Header Watch #1 immediately notifies via hand-held radio the tankerman and Teck Cominco Alaska's fuel transfer Person-in-Charge (PIC) that there is a failure at the header and emergency shutdown is required.

While notifications are being made, Header Watch #2 goes to the top of the gantry and secures the manual valve to prevent back drainage. The barge tankerman activates the emergency shutdown button and ceases all pumping from the barge.

The Teck Cominco Alaska PIC notifies all transfer personnel to close all valves from the current tank being filled to the header area. A total of four valves will be closed. See Figure 6-3 for an illustration of valve location.

Due to Teck Cominco Alaska's fuel transfer protocols, boom was predeployed partially around the fuel barge and provides initial containment of the spill directly downcurrent. See Figure 6-3 for boom placement.

Teck Cominco Alaska senior spill response team member assumes command as IC and directs the 30-foot aluminum, twin 150 out-board spill response vessel pre-staged at the dock to pull additional boom. The IC then performs the IC's checklist procedures set forth in Part 1, Section 1.1.

The IC immediately establishes overall objectives to:

- Assume/confirm command
- Ensure safety of all personnel
- Control spill source
- Contain spill
- Recover spilled material
- Dispose of recovered material
- Restore environment

The IC directs Port Dispatch/Base Radio Station to ensure proper notifications to Environmental Department, Loss Control, and the IMT.
Port Dispatch activates the Port Spill Response Team and then contacts the Mine Site Dispatch/Tool Crib. Mine Dispatch accomplishes the following:

1. Notifies Loss Control, Environmental Department and the IMT.
2. Activates the fire department to provide spill response assistance to the port.
3. Performs the Dispatch/Base Communication Center's checklist procedures set forth in Part 1, Section 1.1, page 1-4.

Senior Environmental Department person is designated as Liaison Officer and makes proper notifications to agencies as outlined in Part 1, Section 1.2. The Liaison Officer also coordinates activation of the OSRO, Alaska Chadux Corporation (ACC). As initial information indicates, a Level III response is required. The ACC's estimated time of arrival is 14 hours.
The IC immediately ensures that the following are completed:

1. The designated Safety Officer conducts air monitoring (LEL, TPH, and O2)
2. Red Dog Mine Fire Department (see Part 1, Section 1.2, Appendix, for Teck Cominco Alaska's call out list) reports that they are responding with Mine Emergency Response Trailer and Spill Response Connexes and personnel. Estimated time of arrival is 1 hour.
3. A small pre-deployment safety meeting is conducted.
4. Containment procedures are established. Priority will be to enclose the barge with containment boom if no fuel has escaped the pre-deployed boom. If fuel has escaped the pre-deployed boom downcurrent, more booms will be strategically placed downcurrent at an angle to allow for a shore side collection area.
5. Teck Cominco Alaska's secondary spill response vessel – 20-foot aluminum weld twin 70's – is placed in the water to assist.

ADEC: The flow rate during transfer was 5,600 gpm and it took approximately 3 minutes for the Header Watch to discover the spill and 1 minute to completely stop fuel transfer. Approximately 22,400 gallons were released into open water.
USCG: The flow rate during transfer was 5,600 gpm and it took approximately 3 minutes for the Header Watch to discover the spill and 30 seconds to completely stop fuel transfer. There are 20,149 gallons in the pipeline between the manifold and the first valve inside secondary containment. (See Figure 6-3 for valve locations.) Approximately 39,749 gallons were released into open water. (See Part 1, Section 1.6.C for worst case discharge calculations.)

The IC determines that the spill is approximately 20,000 to 40,000 gallons spreading rapidly northeast toward the shore off of Cell No. 2.
Immediately after determining that fuel is spilling, the IC designates a firefighting unit to be on standby and instructs them to report directly to OPS. The unit takes the following precautionary actions:

- Locks-out power source to tanks and fuel station.
- Prohibits smoking and open flames (within 50 feet).
- Provides additional fire extinguishers.

Visual discharge tracking was initiated at the onset of the spill. Initial information on winds and weather are provided to the IC by the Port Dispatch/Base Radio Station. Discharge tracking is conducted visually on the ground using Teck Cominco Alaska's 4-wheelers or on foot and on the water using either response vessel. Visual surveillance is conducted every half-hour to provide information for present operations and planning purposes. The reports on location and physical characteristics will be constantly reported to the Situation Leader within the IMT. This will allow for accurate planning for the next operational period.

The Environmental Unit Leader refers to Part 3, Section 3.10, Environmental Sensitive Areas, and identifies probability of risk to the sensitive areas at the Port Site. The Environmental Unit Leader concludes that there will be migration of the fuel from the Chukchi Sea to downcurrent shorelines. Protection of the downcurrent shoreline, especially where birds have been sighted by surveillance crews, is recommended to the Planning Section Chief. See Figure 6-2B for map showing typical boom placement in coastal sensitive areas.

OPS will direct exclusion/diversion booming near the shoreline archaeological sites (graves and reindeer corral) to preserve these environmentally sensitive areas. The Liaison Officer will contact ADNR's State Historic Preservation Office and notify them of the actions.
Birds and wildlife are located in the spill area. The IC determines the potential need for wildlife hazing. This is coordinated through the Environmental Unit. Wildlife hazing will be conducted only with the concurrence of USFWS, NMFS, and ADF&G. If a hazing permit is approved, Teck Cominco Alaska's wildlife hazing unit will conduct the hazing, and will later be supported by its OSRO, ACC. The hazing effort will be under review by the agencies with jurisdiction over the species in question. (See General Response Strategies and Techniques in Appendix A to handle oiled birds and wildlife and methods for hazing.)

An OPS starts deploying Port Site spill response equipment. See Part 3, Section 3.6 for equipment locations. This equipment includes:

1. Port Emergency Trailer and Spill Response Connexes
2. Heavy equipment: loaders, forklifts, end dumps, Challenger (coordinated through Nana Lynden transportation and loaded on wide deck)
3. Pumps and skimmers (in port trailer and connexes)
4. Temporary storage tanks: superdrums; two 8000-gallon water tanks (#8202 and #8204); two 5000-gallon ISO tanks; six 2500-gallon fastanks (fold-a-tanks)
5. 4-Wheeler with trailer
6. Vacuum truck (for recovery of fuel)
7. Lube truck for refueling operations

An Incident Command Post will be set up either at the Port PAC or at the Mine Site Services Complex Training Room.

When Red Dog Mine Fire Department and equipment arrive at the port, they report to the staging area. See Part 3, Section 3.6 for list of equipment in the Mine Site trailer and connexes.

Offshore

- Fuel recovery begins utilizing boats, boom, skimmers and pumps.
- Fuel is pumped into fastanks on cells and/or barge.
- If possible, empty barge tank will be utilized for storage.
- Skimmer heads are tended by task forces in response vessels.

1.10.10 Onshore

- Place visqueen along the shoreline to reduce fuel impact.
- Position fastanks along the shore and superdrums on the dock for recovery and storage activities.
- Shore-side recovery will be accomplished with skimmers in boomed area pumping into a cascade system of fastanks toward the dock.
- Fuel will be pumped from fastank nearest the dock directly into a tank truck tank for disposal.
- Tank trucks will haul fuel to the two 10,000-gallon dedicated spill response tanks at the mine site methanol pad.
- To eliminate the transfer large amounts of seawater, the Liaison Officer will coordinate request for decanting fuel with the ADEC and the USCG.

Pump		**Quantity**	**Unit Rate (gpm)**	**Total Rate (gpm)**
	American Diesel	2	350	700
	Yanmar Diesel	3	350	1,050
	Sandpiper	10	140	1,400
	Water Truck	1	100	100
	Vacuum Truck	1	200	200
Subtotal Pumping Capacity (gpm)				3,450
Total Pumping Capacity (20% Efficiency) (gpm)				690
Daily Pumping Capacity (gpd) (Effective Daily Recovery Rate)				>39,749
72-hour Pumping Capacity (gallons)				>39,749

Shoreline cleanup will be implemented:

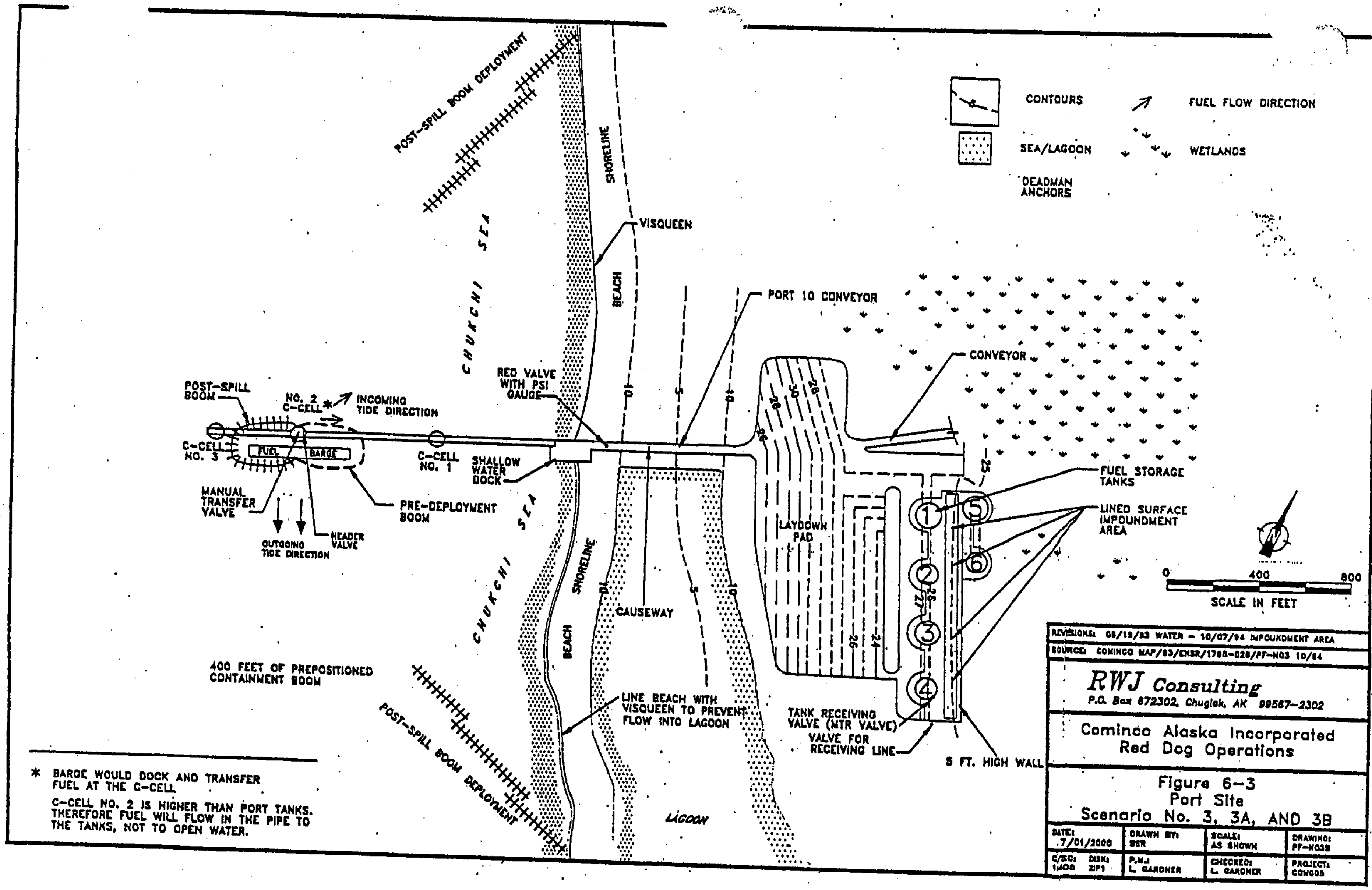
- Use the Sensitivity of Costal Environments and Wildlife to Spilled Oil Northwest Arctic, Alaska Atlas to identify coastal shoreline predictions and predicted oil behavior. Copies of the Atlas are located with the Red Dog Spill Chief and the Senior Environmental Coordinator.
- After reviewing the Atlas beach cleanup would be conducted using heavy equipment (dozers, loaders, and backhoes) to remove heavily contaminated beach sands.

- Final cleanup and cleanup of lightly contaminated areas will likely be accomplished by hand using shovels, rakes, and absorbents. Contaminated soils will be hauled to a remediation treatment cell or will be left in place for in situ bioremediation.

Fuel recovered from the Chukchi Sea may be transferred to empty barge tanks and shipped for off-site treatment and disposal or can be handled on-site by burning for energy recovery in generators. The daily rate that can be burned onsite is dependent upon water/fuel ratio.
An OPS directs a spill response team to conduct the following disposal activity. Disposal options are summarized in Table 6-1.

- Place absorbent pads and debris in lined end-dump trucks.
- Transport contaminated media to the lined pit at the airport and incinerate it at the landfill, if the media is non-hazardous.
- Package and ship media off-site immediately if it is hazardous.

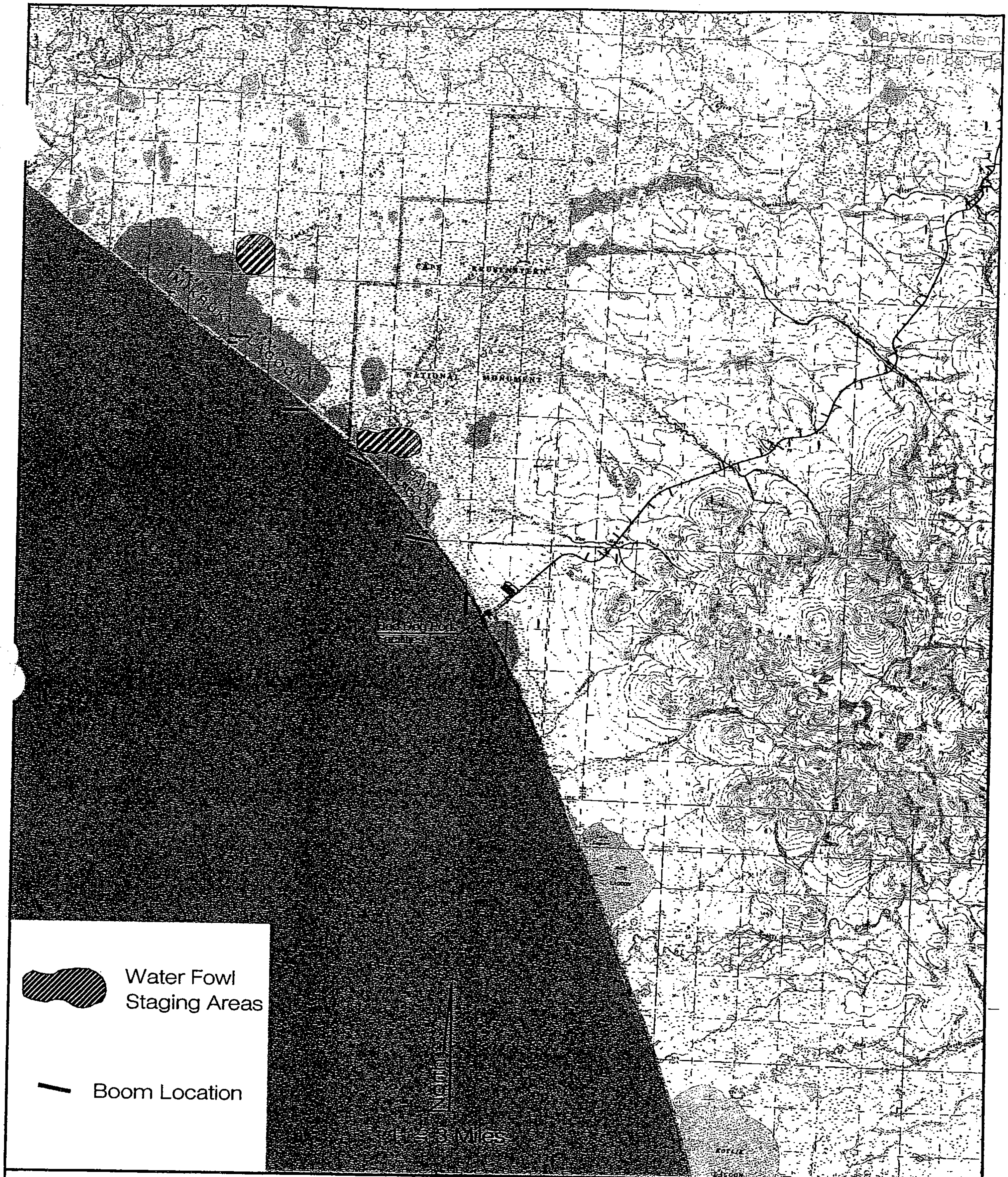
Wildlife carcasses will be collected to prevent secondary contamination of scavengers or predators. Dead animals will be bagged and tagged individually and retained in cold storage until the agencies with responsibility for these animals provide a release allowing for their disposal.
Response times and recovery could take additional time during adverse weather (fog and wind) and rough seas.



POST-SPILL BOOM DEPLOYMENT
SHORELINE
VISQUEEN
BEACH
CHUKCHI SEA
PORT 10 CONVEYOR
CONTOURS
FUEL FLOW DIRECTION
SEA/LAGOON
WETLANDS
DEADMAN ANCHORS
CONVEYOR
RED VALVE WITH PSI GAUGE
POST-SPILL BOOM
NO. 2 C-CELL
INCOMING TIDE DIRECTION
C-CELL NO. 3
FUEL
BARGE
C-CELL NO. 1
SHALLOW WATER DOCK
MANUAL TRANSFER VALVE
PRE-DEPLOYMENT BOOM
HEADER VALVE
OUTGOING TIDE DIRECTION
LAYDOWN PAD
FUEL STORAGE TANKS
LINED SURFACE IMPOUNDMENT AREA
CAUSEWAY
0
400
800
SCALE IN FEET
400 FEET OF PREPOSITIONED CONTAINMENT BOOM
LINE BEACH WITH VISQUEEN TO PREVENT FLOW INTO LAGOON
TANK RECEIVING VALVE (MTR VALVE)
VALVE FOR RECEIVING LINE
5 FT. HIGH WALL
LAGOON
* BARGE WOULD DOCK AND TRANSFER FUEL AT THE C-CELL.
C-CELL NO. 2 IS HIGHER THAN PORT TANKS. THEREFORE FUEL WILL FLOW IN THE PIPE TO THE TANKS, NOT TO OPEN WATER.
REVISIONS: 08/19/93 WATER - 10/07/94 IMPOUNDMENT AREA
SOURCE: COMINCO MAP/93/ENSR/1798-028/PF-N03 10/94
RWJ Consulting
P.O. Box 672302, Chugiak, AK 99567-2302
Cominco Alaska Incorporated
Red Dog Operations
Figure 6-3
Port Site
Scenario No. 3, 3A, AND 3B
DATE: 7/01/2000
DRAWN BY: SSR
SCALE: AS SHOWN
DRAWING: PF-N03B
C/SC: 1:400
DISK: ZIP1
P.M.: L. GARDNER
CHECKED: L. GARDNER
PROJECT: COM005

Attachment 2

Primary Waterfowl Staging Areas and Pre-Established Containment and Diversion Boom Locations



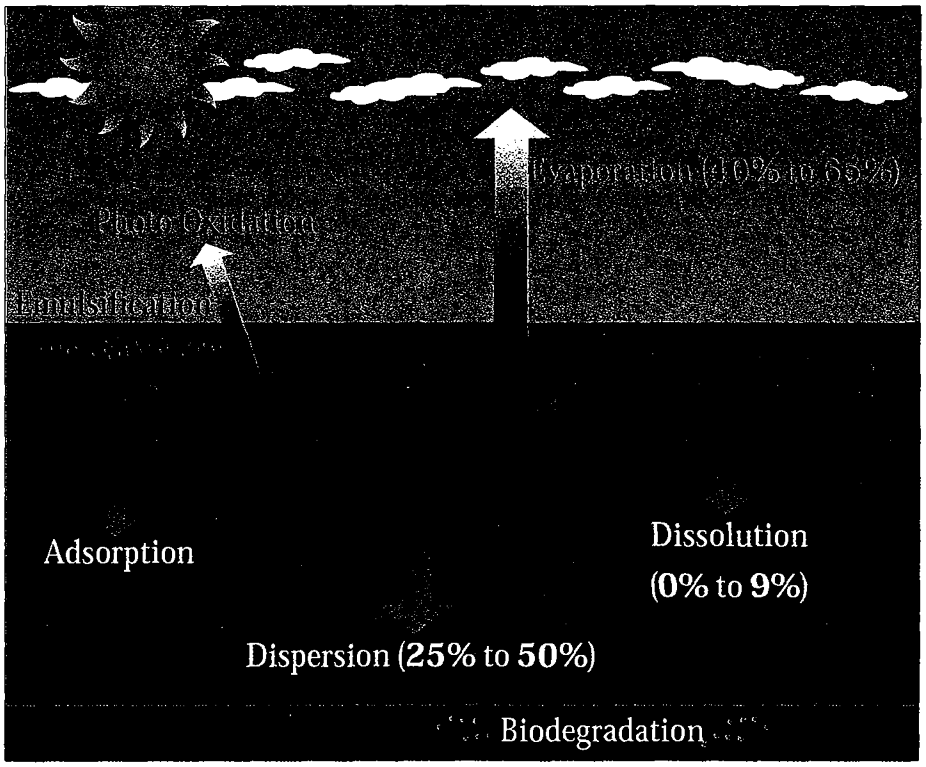
Red Dog Mine Typical Boom Placement In Coastal Staging Areas	Drawn By: SOH	Design Date:	Department	Reviewed By	Date
	Checked By:	Check date:	Mine Engineering		
	teckcominco		Mine Operations		
			Survey		
			Geology		
Revision: 0	Scale: 1" = 3 Miles	MWO/Job No:	Approved by:		Date: 12/31/02

Computer File: T:\Mine\Maps\PortlCS.dwg

Attachment 3

NOAA Diesel Fuel Fact Sheet

Weathering Processes Affecting Small Diesel Spills (500-5000 gallons)



Over 90% of the diesel in a small spill incident into the marine environment is either evaporated or naturally dispersed into the water column in time frames of a couple of hours to a couple of days. Percent ranges, in parentheses above, represent effects of winds ranging from 5 to 30 knots.

Adsorption
The process by which one substance is attracted to and adheres to the surface of another substance without actually penetrating its internal structure

Biodegradation
The degradation of substances resulting from their use as food energy sources by certain micro-organisms including bacteria, fungi, and yeasts

Dispersion
The distribution of spilled oil into the upper layers of the water column by natural wave action or application of chemical dispersants

Dissolution
The act or process of dissolving one substance in another

Emulsification
The process whereby one liquid is dispersed into another liquid in the form of small droplets

Evaporation
The process whereby any substance is converted from a liquid state to become part of the surrounding atmosphere in the form of a vapor

Photo Oxidation
Sunlight-promoted chemical reaction of oxygen in the air and oil

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FACT SHEET: Small Diesel Spills (500-5000 gallons)

- Diesel fuel is a light, refined petroleum product with a relatively narrow boiling range, meaning that, when spilled on water, most of the oil will evaporate or naturally disperse within a few days or less. This is particularly true for typical spills from a fishing vessel (500-5,000 gallons), even in cold water. Thus, seldom is there any oil on the surface for responders to recover.
- When spilled on water, diesel oil spreads very quickly to a thin film. Even when the oil is described as a heavy sheen, it is 0.0004 inches thick and contains about 1,000 gallons per square nautical mile of continuous coverage. The volume of oil in areas covered by streamers would be much less. Silver sheen only contains about 75 gallons per square nautical mile.
- Diesel has a very low viscosity and is readily dispersed into the water column when winds reach 5-7 knots or sea conditions are 2-4 foot.
- Diesel oil is much lighter than water (specific gravity is about 0.85, compared to 1.03 for seawater). It is not possible for this oil to sink and accumulate on the seafloor as pooled or free oil.
- However, it is possible for the oil to be physically mixed into the water column by wave action, forming small droplets that are carried and kept in suspension by the currents.
- Oil dispersed in the water column can adhere to fine-grained suspended sediments which then settle out and get deposited on the seafloor. This process is more likely to occur near river mouths where fine-grained sediment are carried in by rivers. It is less likely to occur in open marine settings. This process is not likely to result in measurable sediment contamination for small spills.
- Diesel oil is not very sticky or viscous, compared to black oils. When small spills do strand on the shoreline, the oil tends to penetrate porous sediments quickly, but also to be washed off quickly by waves and tidal flushing. Thus, shoreline cleanup is usually not needed.
- Diesel oil is readily and completely degraded by naturally occurring microbes, under time frames of one to two months.
- In terms of toxicity to water-column organisms, diesel is considered to be one of the most acutely toxic oil types. Fish, invertebrates and seaweed that come in direct contact with a diesel spill may be killed. However, small spills in open water are so rapidly diluted that fish kills have never been reported. Fish kills have been reported for small spills in confined, shallow water.
- Crabs and shellfish can be tainted from small diesel spills in shallow, nearshore areas. These organisms bioaccumulate the oil, but will also depurate the oil, usually over a period of several weeks after exposure.
- Small diesel spills can affect marine birds by direct contact, though the number of birds affected is usually small because of the short time the oil is on the water surface. Mortality is caused by ingestion during preening as well as to hypothermia from matted feathers. Experience with small diesel spills, is that few birds are directly affected. However, small spills could result in serious impacts to birds under the "wrong" conditions, such as a grounding right next to a large nesting colony or transport of sheens into a high bird concentration area.